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Paul A. Morrison

BACKLOG OF ESSENTIAL MAINTENANCE AND REPAIR (BEMAR) AS AN INDICATOR OF REAL PROPERTY CONDITION

by

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BACKLOG OF ESSENTIAL MAINTENANCE AND REPAIR (BEMAR) AS AN INDICATOR OF REAL PROPERTY CONDITION

Paul A. Morrison, M.P.W., M.S.C.E.

University of Pittsburgh, 1970

The purpose of this thesis is to provide an "information base" for further research (provide a basic understanding of the Backlog of Essential Maintenance and Repair (BEMAR) problem) and to review BEMAR as a real property condition indicator. Backlog of Essential Maintenance and Repair (BEMAR) is used by the Department of Defense (DOD) as a facilities condition indicator for justifying requests from the shore station commands and activities to the departments (Army, Navy, etc.), DOD, and the Congress for funds in the public works area (BEMAR is used as an indicator since no other indicator is available). The increasing trend in dollar value of BEMAR results from: the inability to initially obtain or retain sufficient funding in the

maintenance "floor" area; the fact that the major portion of maintenance "floor" funds goes for recurring maintenance, leaving an insufficient balance for elimination of the BEMAR; escalating costs for labor and material; and, additional cost incurred due to deferrals and deletions of major construction projects. The main effects to the Navy of inadequate maintenance funds are: detriment to readiness and fleet support, adverse working and living conditions for personnel, accelerated deterioration of facilities, and the probability of greater costs when the postponed work must be done later. According to the Navy, there is no apparent deleterious affect on operations due to these effects. Decision makers have lost confidence in the credibility of BEMAR as an indicator. What is needed is an indicator of real property condition that can be related to operational necessity; an indicator that will be recognized as valid by decision makers.

The author interviewed numerous personnel concerned with the BEMAR problem at the headquarters' level in Washington, D.C. An extensive search was made at Washington headquarters for research materials bearing on the problem. With the understanding gained through the interviews and study of the materials, the author attempts for what he believes to be the first time to tell the whole BEMAR story; to relate all the "pertinent"

factors bearing on the BEMAR problem. Due to the magnitude of this undertaking little more than the raising of problems has been accomplished. Little is offered as corrective action; however, areas requiring further research are stated.

An apparent conflict over the purpose of facilities was noted and before any facility condition indicator system can be implemented, precise definition of both maintenance policy and essentiality is required in order to resolve this conflict. It must be decided if maintenance policy is to be: (a) a uniformly high standard of maintenance to act as a cushion so that facilities will withstand the period of neglect that occurs after mobilization, or (b) facilities maintenance programmed on the basis of impact on mission. If (a) is selected, then a return to the concept of a single executive for real property maintenance is required. If (b) is selected, maintenance decisions must be made at the activity level with suitable indicators available to provide higher command levels with information to evaluate program performance and determine distribution of resources. Regardless of the maintenance policy implemented; a better facility condition indicator is required, Current Plant Value should be implemented service-wide as a common denominator in the analysis of the management of real property maintenance, the relationships

of items that influence BEMAR must be clarified, and the decision making procedure for all maintenance activities must be standardized. The author concludes that the justification of maintenance expenditures will in the future be made on the basis of the cost effects of deferral, and efforts must be continued toward development of methods of determining maintenance deferral costs.

DESCRIPTORS

Maintenance	Real Property
Public Works	Budgeting
Maintenance Management	

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GLOSSARY

Accrual Accounting. "The accrual accounting concept requires that the accountant charge an activity for resources as they are consumed. (Does not eliminate the accounting for obligations since Congress still requires obligational control.)"(1)*

Activity (also shore or field activity). "A unit of the Naval Establishment, of distinct identity, established ashore under an officer in command or in charge."(2)

Addition, Expansion, Extension. "A physical increase to a real property facility that adds to the overall external dimension of the facility."(3)

Alteration. "Work required to adjust interior arrangements, on-base location, or other physical characteristics of an existing facility so that it may be more effectively adapted to or utilized for its designated purpose. Additions, expansions, and extensions are not alterations."(4)

Annual Inspection Summary. "A facility condition report which lists the maintenance deficiencies in existing buildings, structures, utilities systems, and other facilities..."(5)

Appropriation Act. See Operations and Maintenance Appropriation.

Backlog of Essential Maintenance and Repair (BEMAR). "The backlog of essential maintenance and repair consists of those items of maintenance and repair as defined in DOD Directive 7040.2 over $10,000 which cannot be accomplished during the current fiscal year due to lack of resources. An item is considered essential when delay for inclusion in a future program will impair the military readiness and capability, or will cause significant deterioration of real property facilities."(6)

Category Codes. Category codes for military real property are the "... standard codes and nomenclatures for codifying Class I and II Real Property (land and improvements thereto) owned or controlled by the Department of the Navy. These codes provide the means to

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* Parenthetical references placed superior to the line of text refer to the bibliography.

uniformly classify all real property of the Navy from the initial planning stages through the complete cycle of programming, construction, inventory, accountability and maintenance."(7) The basic "three digit" category code breaks down as follows:

> Facility Class: the "first" digit identifies the facility class. Facility classes, comprising various category groups, are the major type of facilities; e.g., "Operational and Training Facilities", "Maintenance and Production Facilities", etc. There are nine facility classes. Example: Maintenance and Production Facilities, facility class 200; Supply Facilities, 400.
>
> Category Group: the "second" digit identifies the category group "within" each facility class. Example: Maintenance Group, category group 210; Production, 220.
>
> Basic Category: the "third" digit identifies the basic category items "within" each category group. Example: Public Works, Repair and Operation, Basic Category 219; Missiles 212.
>
> Navy Code: the "fourth and fifth" digits (Note: this is in addition to the basic "three digit" category code) identify the specific term "within" each basic category. Example: Public Works Shop, Navy Code 219 10; Public Works Shops Store 219 25.

Chief of Naval Operations Budget Office (CNOBO). "The office which distributes funds to all Naval and Marine corps activities operating under Project PRIME."(8)

Civil Engineering. A term used in this thesis "... generically to include the employment of all disciplines required in the planning, design, construction (or other means of acquisition), maintenance, alteration, operation and disposal of shore facilities. It includes disciplines other than engineering, such as architecture, landscape architecture, urban planning, conservation, forestry, etc. Normally, it does not include industrial engineering applicable to weapons/equipment development, production and maintenance processes, nor to shore electronics engineering matters."(9)

Class I Real Property. Land.(10)

Class II Real Property. Improvement to land (buildings, structures, and utilities).(11)

Commanding Officer (CO). "The commanding officer, officer in charge, commander, director (or other appropriate title) of an activity, which receives an allotment of funds from an appropriation available for operations and maintenance, or which operates under an industrial fund or on a modified industrial accounting system."(12)

Commercial and Industrial Facilities. "Facilities that normally perform services or produce goods similar to those produced by private industry, except commissaries, post exchanges, and other nonappropriated fund activities."(13)

Concurrent Construction Requirements. "Requirements which, under normal circumstances, can be recognized to exist at the same time and which would be expected to be satisfied at the same time."(14)

Construction. "The erection, installation, or assembly of a new facility; the addition, expansion, extension, alteration, conversion, or replacement of an existing facility; or the relocation of a facility from one installation (an "activity" as previously defined) to another. Includes equipment installed and made a part of such facilities, and related site preparation, excavation, filling and landscaping, or other land improvements."(15)

Construction Project. "A single undertaking involving construction applicable to one or more real property facilities that will include all construction work, land acquisition, and items of installed equipment necessary to accomplish a specific purpose and produce a complete and usable real property facility or a complete and usable improvement to a real property facility. Items of personal property (furniture and production, processing, training, RDT & E, etc., equipment) unless otherwise specified, are not to be included in a construction project."(16)

Conversion. "A major structural revision of a facility that changes the functional purpose for which it was originally designed or utilized."(17)

Cost Account Codes. "Standard codes which identify organizational units of cost centers and sub-cost centers, e.g. work centers, supervisory levels, or other areas of responsibility."(18)

Cost Center. "The individual organizational units of a responsibility center, e.g. departments or staff offices."(19)

Demolition. "The razing or removal of a facility. Includes work to restore the site to a condition equivalent to the surroundings. Performed as an element of a construction project when so related, otherwise performed as a repair."(20)

Dissimilar Real Property Facilities. "Facilities that have different 3-digit category codes."(21)

Element of Expense. Same as Expense Element.

Emergency Construction. "All construction funded by military construction appropriations under the authority of Section 2037 of the current Military Construction Authorization Act."(22)

Engineering Field Division (EFD). NAVFAC representative for a particular geographic area. (Formally called Bureau Field Division (BFD)).(23)

Essentiality. Contained within the Backlog of Essential Maintenance and Repair (BEMAR) definition.

Expense Element. "Expense elements specify the type of resources being consumed in the functional category or program element. This information is useful in planning requirements and in the analysis of performance."(24) Examples of expense elements are: Military Personnel, Civilian Personnel, Travel of Personnel, Transportation of things, Utilities and Rents, Communications, Printing and Reproduction, Equipment, etc.(25)

Expense Operating Budget (EOB). Same as Operating Budget.

Facilities Management. "Facilities Management is the direction, control, appraisal and equitable distribution according to relative need of resources required for Facilities Management Functions."(26)

Facilities Management Functions. "Facilities Management Functions are the maintenance, alteration, repair, overhaul, and disposal of land and improvements (Class I and II Property); the procurement and production of utilities and the operation of utilities distribution systems; the operation and maintenance of construction, weight handling, and automotive and railway transportation equipment; and the provision of public works engineering and other services."(27)

Facility. "A separate, individual building, structure, or other item of real property, including land, which is subject to separate reporting under the Department

of Defense real property inventory."(28) (Note: "land" may not be included under this definition in certain cases.)

Fiscal Year (FY). From 1 July to 30 June.

Functional Area. "A functional area represents a key function or sub-function which has been selected for coverage under the System."(29) See Logistics Performance Measurement and Evaluation System (LPMES).

Functional Category/Subfunctional Category. "Functional categories are designed to collect expense information for one or more of the following reasons: (1) the cost of the function is required to meet restrictions made by the Congress or to meet the needs of outside parties; (2) information on the cost of a function is useful in deciding on the authorization to be provided to an operating activity; (3) the cost of the function provides a control total tied to an underlying cost accounting system needed for management of the function; and (4) the cost of the function is useful in making comparisons and special analyses of cost."(30) The functional categories are: Mission Operations, Supply Operations, Maintenance of Material, Property Disposal, Medical Operations, Personnel Support, Base Services, Operation of Utilities, Maintenance and Repair of Real Property, Minor Construction, Other Engineering Support, and Administration.(31) There are subfunctional categories within certain functional categories, for example: Maintenance and Repair of Real Property has subfunctional categories; (M1), recurring maintenance; and (M2), major repair projects.

Functional Purpose. "The use made of a facility or part thereof as expressed in the general terms listed as 3-digit basic categories. As used herein, the term "functional purpose" shall be considered as applying to the purpose to be served <u>after</u> completion of construction."(32)

Funded Project Cost. "Total out-of-pocket expenses whether from appropriated funds, nonappropriated funds, or overhead at NIF and Modified Industrial Activities. Includes direct labor charges; overhead costs; all contract costs, except A & E fees; acceleration of direct labor costs; cost of direct material used in the project; and cost of land acquisition. For minor construction, also includes directly related transportation costs, overhead costs that may be charged by NAVFAC, and directly related travel and per diem for troop labor. Excludes "unfunded project costs" defined in this Glossary."(33)

Inactive Installations. "All installations identified as "Inactive", "Standby" or "Excess" in Inventory of Military Real Property,..."(34)

Installation. "The aggregate of the facilities (real property) assigned to a naval shore (field) activity."(35)

Installation of Equipment. "The work necessary to install or relocate equipment (personal property) procured for a purpose other than an undertaking for construction, alteration, repair, or maintenance of a facility."(36)

Installation Equipment. "Sometimes called "built-in equipment," it is accessory equipment and furnishings that are required for operation and affixed as a part of the building or facility. The equipment is engineered and built into the facility as an integral part of the final design, as an essential part thereof. Equipment of this category is considered part of the facility and is normally taken up as Real Property Class II."(37)

Job Order Number. "Coded numbers used to describe type of expense for each cost account code, such as military costs, civilian costs, material costs, etc."(38)

Logistics Performance Measurement and Evaluation System (LPMES). "... A uniform system for measuring and evaluating specific logistics functional areas to ensure that the Department of Defense is achieving the most effective and efficient use possible of logistics resources... The objective of the System is to concentrate management improvement actions on persistent problem areas by establishing performance objectives and evaluating performance against these objectives in areas where current progress is substantially below that desired."(39)

Maintenance. "The recurrent, day-to-day, periodic, or scheduled work, required to preserve or restore a facility to such condition that it may be effectively utilized for its designated purpose. Includes work undertaken to prevent damage to a facility that otherwise would be more costly to restore."(40)

Maintenance Floor. "Maintenance Floor is established by the Congress and is the amount allocated for maintenance, repair and alterations (functional categories M and R). (Funds allocated for this purpose may not be used for any other purpose.)"(41)

Maintenance Levels. "The maintenance level is the established level at which any real property facility, in

which the Navy has an interest, should be maintained or operated to assure maximum overall economy consistent with its functional requirement and to protect the Government's investment..."(42)

Major Claimants. "The Bureaus, Offices or Commands under CNO, which administer funds for their subordinate commands."(43)

Minor Construction. "This term describes all construction performed: (1) with funds available for operations and maintenance, (2) from overhead at Naval Industrial Fund and Modified Industrial Activities, and (3) urgently required construction financed with military construction appropriations under the authority of Title 10 USC 2674 for the Active Forces and under Title 10 USC 2233(a) for Reserve Forces."(44)

Multiuse Facility. "A facility that has more than one functional purpose although assigned to one category code. To classify a facility under this heading, the functional purpose included must be unrelated."(45)

NAVFAC REP. "The NAVFAC REP is an organizational part of the EFD. Its function is to provide to a designated Command professional advice and assistance on the full scope of facilities matters for which the Command has responsibility."(46)

New Obligational Authority (NOA). "It is a limitation imposed by Congress at the lowest responsible organizational level, andif exceeded, a report must be submitted to explain the Section 3679 R.S. Administrative violation."(47)

Operating Activity. "A major organizational subdivision or entity that is responsible for execution of an identifiable segment of a program."(48)

Operating Budget (also called Expense Operating Budget, EOB). "An approved operating plan which is the basis of authorization and financial control of expenses and selected working capital in the execution of a program or programs."(49) The operating budget gives economical recognition to all known requirements (all personnel, material, services, maintenance, etc.). The budget input to the Commanding Officer is in terms of cost centers, broken down by cost account codes. The input to higher authority is in terms of functional category/subfunctional category.(50)

Operations and Maintenance (O & M) Appropriation. Also refered to as O & M for Operations and Maintenance,

Navy Appropriations; O & M A, Army, etc. A partial list of items under the O & M Appropriation is: necessary for the operation and maintenance of the Navy, including aircraft and vessels; design of vessels; training and education of members of the Navy; administration; welfare and recreation; medical and dental care; repair of facilities; installation of equipment in public or private plants; etc.(51) In the DOD Appropriation Act, 1970, $6,037,300,000 of which not less than $147,300,000 only for maintenance of real property facilities (Maintenance Floor) was appropriated.(52) Other appropriations are: Military Personnel; Procurement; Research, Development, Test and Evaluation (RDT & E); Military Construction; Family Housing; etc.

Permanent Building Construction. "Permanent building construction is that which produces a building suitable and appropriate to serve a specific purpose for a maximum period of time (at least 25 years) and with a minimum of maintenance."(53)

Personal Property. "Sometimes called 'plant equipment' or 'equipment in place', it is accessory equipment and furnishings that are movable in nature and not affixed as an integral part of the facility."(54)

PRIME: Priority Management Effort. "When accompanied by a year, i.e. PRIME '70, it refers to the management efforts of that particular year."(55)

Program Element. "The basic building block of the Five-Year Defense Program that is a description of the mission to be undertaken and a collection of the organizational entities identified to perform the mission assignment. Elements may consist of forces, manpower, material, services and associated costs as applicable."(56)

Project. "A single planned undertaking of construction, repair, maintenance work, or equipment installation either separately or in combination, necessary to satisfy a finite requirement. Not to be confused with the term 'project' as used in congressional military construction legislation."(57)

Real Property Facility. "A separate individual building, structure, or other real property improvement. A real property facility shall be assigned only one 3-digit category code based on the primary construction category."(58)

Real Property Maintenance Activities (RPMA). Precisely, "the term Real Property Maintenance Activities relates

to the activities responsible for management and execution of RPMA 'functions', normally the post engineer, civil engineer, of public works office, or equivalent organizational element of an installation."(59) However, common usage is to refer to RPMA functions as RPMA. These functions include functional categories: Maintenance of Real Property, Utility Operations, Other Engineering Support, and Minor Construction.

Related Functional Purpose. "Related functional purposes are two or more functions that are normally required to carry out a specific task; and should one of the functions be discontinued, the other function could not be accomplished. For example, in a warehouse that has an administrative space as an integral part of the facility in which functions are performed for the proper operation of the warehouse, the administrative and warehousing functions are related. If the functions performed in the administrative space have no connection with the warehouse operation (such as a tenant relationship), the administrative and warehouse functions would be unrelated."(60)

Repair. "The restoration of a facility to such condition that it may be effectively used for its designated purposes by overhaul, reprocessing or replacement of constituent parts or materials that have deteriorated by action of the elements, or wear and tear in use, and have not been corrected through maintenance."(61)

Replacement. "A complete reconstruction of a real property facility destroyed or damaged beyond the point at which it may be economically repaired."(62)

Resource Management Systems. "Resource management systems include all procedures for collecting and processing recurring quantitative information that (1) relates to resources and (2) is for the use of management. They also include procedures which are closely related to quantitative systems even though the systems may not themselves be primarily quantitative. Resources are men, materials (i.e., real and personal property), services and money."(63)

Responsibility Center. "A command which has been assigned responsibility for its operating funds. This normally would equate to commanding officers and Officers-in-Charge."(64)

Semi-Permanent Building Construction. "Semi-permanent building construction is that which produces a building suitable and appropriate to serve a specific purpose for a limited period of time (less than 25 years and more

than 5 years) and with a moderate to high degree of maintenance."(65)

Similar Real Property Facilities. "Facilities having the same 3-digit category code."(66)

Special Project. "A project--above the approval authority of the commanding officer--for maintenance, repair, minor construction, or equipment installation, to be financed from appropriations available for operations and maintenance, from overhead, or from nonappropriated funds."(67)

Subclaimant/Expense Limitation Holder/Functional Commander. "Designation given various intermediate commands such as Systems Commands, Type Commands or Air Training Commands."(68)

Sub-Cost Center. "Organizational breakdown of a cost center, e.g., division, office, shop. (Sub-cost centers are identified and reported under PRIME at the Commander's discretion.)"(69)

Support Agency. "The bureau, command, systems command, or office that is assigned the responsibility to provide resources to an activity--as in the case of RDT & E; or the bureau, command, systems command, or office that is responsible for providing 'personal property' equipment to a shore activity."(70)

Systems Command. See Figure 3.

Temporary Building Construction. "Temporary building construction is that which produces a building suitable and appropriate to fill a need for a short period of time (five years or less) without regard to degree of maintenance, and the design and details of which provide minimum facilities with maximum initial economics."(71)

Total Direct Expense. "... consists of all expenses including military personnel costs (but excluding anticipated reimbursables)."(72)

Unfunded Project Cost. "Costs used for statistical purposes only, or in request for funds as in case of A & E fees. Unfunded project costs include:

> Costs financed from military personnel appropriations.
>
> Depreciation of Government-owned equipment.

aterials, supplies, and installed capital type equipment obtained on a nonreimbursable basis or as excess distributions from other than the Department of the Navy.

Engineering services, such as soil borings, surveys, inspections, and various types of testing.

Planning and design costs. When plans and specifications are done on A & E contract, in no event shall the A & E fee exceed 6 percent of the estimated cost of construction. The A & E fee limitations, however, do not apply to engineering services."(73)

Unilinear Navy. One "chain of command" from CNO to activity. Formally, had a command "chain" and a resources "chain".

Work Units. Units of work used in the preparation of budgets and management reports. By comparing budgeted and actual work units and costs on the same report, officers at all levels are provided with business oriented management information.(74)

INDEX OF ABBREVIATIONS

The abbreviations listed are not necessarily official Navy abbreviations, but are simply those found in reference sources used by the author. In certain cases, other abbreviations used for the item appear in parenthesis.

ADMINO-	Administrative Officer (NAVADMINO)
AIR-	Naval Air Systems Command (NAVAIR)
AIS-	Annual Inspection Summary
BEM-	Backlog of Essential Maintenance (now BEMAR)
BEMAR-	Backlog of Essential Maintenance and Repair (formally BEM)
BEMH-	Bachelor Enlisted Men's Housing
BFD-	Bureau Field Division (now EFD)
BFRL-	Basic Facilities Requirements List
BOB-	Bureau of the Budget (now Office of Management and Budget)
BUDOCKS-	Bureau of Yards and Docks (now NAVFAC)
CC-	Component Condition
CCI-	Component Condition Index
CINCLANT-	Commander in Chief, U.S. Atlantic Fleet (CINCLANTFLT)
CINCNAVEUR-	Commander in Chief, U.S. Naval Forces Europe (CINCUSNAVEUR)
CINCPAC-	Commander in Chief, U.S. Pacific Fleet (CINCPACFLT)
CMC-	Commandant of the Marine Corps
CNATRA-	Chief of Naval Air Training
CNM-	Chief of Naval Material (CHNAVMAT)
CNM FRO-	Chief of Naval Material, Fund Resource Office
CNO-	Chief of Naval Operations
CNOBO-	Chief of Naval Operations Budget Office
CNP-	Chief of Naval Personnel (Chief, BUPERS)
CNRTC-	Commander, Naval Reserve Training Command (COMNAVRESTRACOM)
CO-	Commanding Officer
COMM-	Commander, Naval Communications Command (COMNAVCOMMCOM)
COMNAVFAC-	Commander, Naval Facilities Engineering Command (formally Chief, BUDOCKS)
CPRN-	Command Priority Rating Number
CPV-	Current Plant Value (formally PRV)
CR-	Component Rating

DASD-	Deputy Assistant Secretary of Defense
DOD-	Department of Defense
EFD-	Engineering Field Division (formally BFD)
ELEC-	Naval Electronic Systems Command (NAVELEC)
EOB-	Expense Operating Budget
FAC-	Naval Facilities Engineering Command (NAVFAC)
FC-	Facility Condition
FCE-	Facility Condition Evaluation
FCI-	Facility Condition Index
FI-	Facility Index
FY-	Fiscal Year
FYDP-	Five Year Defense Plan
GNP-	Gross National Product
IC-	Installation Condition
ICI-	Installation Condition Index
I & H-	Installations and Housing
I & L-	Installations and Logistics
INST-	Instruction
INTEL-	Commander, Naval Intelligence Command
J-	Job Factor
LPMES-	Logistics Performance Measurement and Evaluation System
MC-	Maintainability Cost Factor
MED-	Chief, Bureau of Medicine and Surgery
MF-	Mission Factor
MFR-	Memorandum for the Record
MIC-	Management Information Center
MSI-	Marshall Stevens Index
MU-	Facility Measured Units
NAVCOMPT-	Comptroller of the Navy
NAVEXOS-	Naval Executive Office of the Secretary
NAVFAC-	Naval Facilities Engineering Command
NAVFACREP-	Naval Facilities Engineering Command Representative
NAVMAT-	Naval Material Command (NMC)
NAVSO-	Navy Staff Offices
NI-	Installation Index
NIF-	Naval Industrial Fund
NMC-	Naval Material Command (NAVMAT)
OASD-	Office of the Assistant Secretary of Defense
OCEANO-	Oceanographer of the Navy (NAVOCEANO)
O & M-	Operations and Maintenance (implies O & M Appropriation)
O & MN-	Operations and Maintenance Navy (implies Navy part of O & M Appropriation)
OPNAV-	Office of the Chief of Naval Operations
ORD-	Naval Ordinance Systems Command (NAVORD)
OSD-	Office of the Secretary of Defense
O9B-	Chief of Naval Operations Code (responsible for certain shore (field) activities)
P & I-	Property and Installations

PRIME-	Priority Management Effort
PRN-	Priority Rating Number
PRV-	Plant Replacement Value (now CPV)
PWC-	Public Works Center
PWD-	Public Works Department
PWO-	Public Works Officer
RDT & E-	Research, Development, Test and Evaluation (implies RDT & E Appropriation)
RDT & E,N-	Research, Development, Test and Evaluation, Navy (implies Navy part of RDT & E Appropriation)
RF-	Replacement Value Factor
RMS-	Resources Management System
RPM-	Real Property Maintenance
RPMA-	Real Property Maintenance Activities
SECDEF-	Secretary of Defense
SECGRU-	Commander, Naval Security Group Command (COMNAVSECGRU)
SECNAV-	Secretary of the Navy
SHIP-	Naval Ship Systems Command (NAVSHIP)
SPO-	Project Management Offices (part of Naval Material Command)
SUP-	Naval Supply Systems Command (NAVSUP)
TSC-	Technical Services Corporation
UIC-	Unit Identification Code
USMC-	United States Marine Corps
VASP-	Validated Special Project
WEA-	Director, Naval Weather Service Command (DIRNAVWEASERV)

1.0 INTRODUCTION

1.1 General

Backlog of Essential Maintenance and Repair (BEMAR)[1] is used by the Department of Defense (DOD) as a facilities (real property) condition indicator for justifying requests from the shore station commands and activities to the departments (Army, Navy, etc.), DOD, and the Congress for funds in the public works area (Appendix A).[2] Backlog of Essential Maintenance and Repair consists of major repair projects (estimated to cost $10,000 or more), which are projects for the repair of real property facilities: buildings, utilities, waterfront structures, etc.[3] The target for BEMAR (dollar limit that BEMAR should not exceed) is ¼% of the Current Plant Value (CPV)[4] of real property facilities supported by the Operations and Maintenance Navy (O & MN) Appropriations. This target of ¼% represents

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[1] Once introduced, abbreviations will be used except where the longer form is needed for clarity. All abbreviations are listed in the Index of Abbreviations.

[2] Appendix A contains the correspondence that introduced the BEMAR problem to the author.

[3] Repair projects estimated to cost less than $10,000 must be funded from station operation and maintenance funds.

[4] Current Plant Value for that portion of the Navy plant supported from the O & MN Appropriation was $13.6 billion at the beginning of fiscal year 1970. The total Navy plant value at this time was $27.8 billion.

a generally acceptable plant condition.(75)* and will be discussed further under 3.2.

In recent years, Congress has specified in the DOD Appropriation Act, a minimum level of funding for real property maintenance called the maintenance "floor". This "floor" was established to ensure that maintenance funds would not be diverted for other purposes. Three kinds of maintenance work are included in this "floor": minor construction, recurring maintenance such as painting or patching, and major repairs costing $10,000 or more (BEMAR). The increasing trend in dollar value of BEMAR, Figure 1, results from: inability to initially obtain or retain sufficient funding in the maintenance "floor" area; the fact that the major portion of maintenance "floor" funds goes for recurring maintenance, leaving an insufficient balance for elimination of the BEMAR; escalating costs for labor and material; and, additional costs incurred due to deferrals and deletions of major construction projects.[1](76)

The main effects to the Navy of inadequate maintenance funds include: detriment to readiness and fleet support (55% of the BEMAR involves waterfront and air

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* Parenthetical references placed superior to the line of text refer to the bibliography.

1 Facilities that are scheduled for replacement under a major construction project receive minimal maintenance. Upon deferral or deletion of the project, excessive recurring maintenance costs are incurred and/or major repairs are required.

BACKLOG OF ESSENTIAL
MAINTENANCE & REPAIR
(BEMAR)
TRENDS (77)

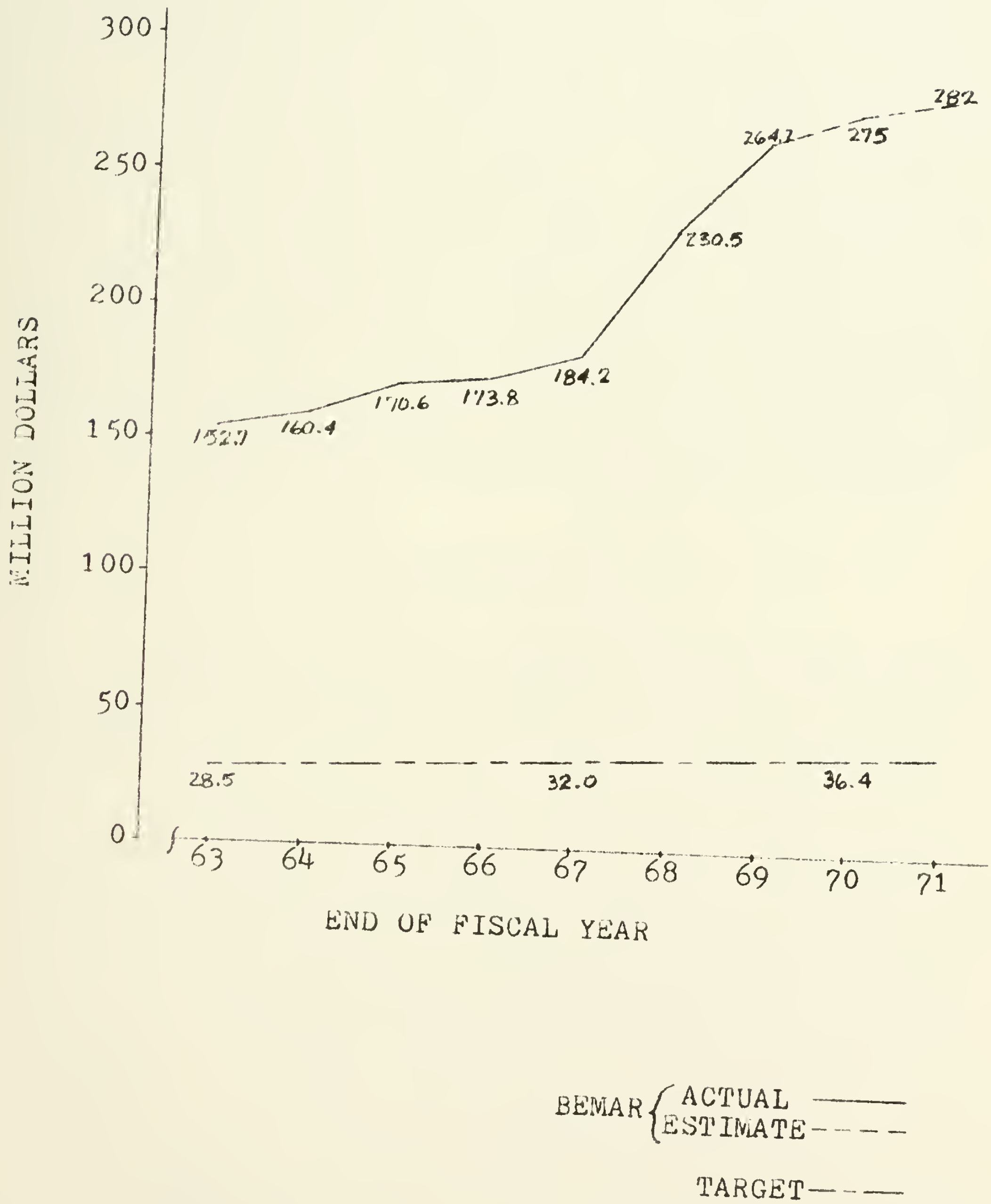

FIGURE 1

station facilities, dredging and utilities), adverse working and living conditions for civilian and military personnel, accelerated deterioration of facilities, and the probability of greater costs when the postponed work must be done later.(78) There is no apparent deleterious effect on Navy operations due to these effects.

As Figure 1 illustrates, BEMAR has been growing consistently for several years. The projected Navy BEMAR for the end of fiscal year 1971 is $282 million or eight times the target (½% of CRV). Therefore, it appears that BEMAR as an indicator of real property maintenance condition is inadequate; that an indicator that can be related to operational necessity is required.

1.2 Objectives

This thesis will attempt, for what the author believes to be the first time, to tell the whole BEMAR story. Much has been written about the BEMAR problem but these writings have been "bits and pieces" relating to this problem. An undertaking of this magnitude would be overly ambitious if an attempt was made to analyze all factors and make detailed recommendations for improvements regarding all factors. This will not be done. Rather, an overview of what the author believes to be all the pertinent factors bearing on the BEMAR problem will be presented.

First, this overview will provide information as to what research work has been done, the results of this research, and where possible, the uses of these results. Most readers will be surprised to learn of the extent of research completed.

A second objective will be to provide in one document information adequate to acquaint readers without expert knowledge concerning BEMAR with a basic understanding of this problem. If nothing more than an appreciation for the complexity of the problem is gained, this undertaking will have served a useful purpose. Appendix A indicates that too many "key" persons do not understand the significance and complexity of the maintenance backlog problem. The "experts" should find this thesis useful in providing them with a summary of what has been done. It is expected that there will be much disagreement among the "experts" as to what needs to be done.[1]

The third objective will be to provide an "information base" for further research. It is the author's goal in presenting this thesis to stimulate interest in further research of the BEMAR problem by the Civil Engineer Corps Officers who pursue the University of

[1]Many of the pertinent factors affecting BEMAR require extensive use of subjective evaluations. There appears to be an aversion to the use of subjective evaluations by some of those concerned with the backlog problem.

Pittsburgh's Master of Public Works and Master of Science in Civil Engineering program.[1] Due to the complexity of this problem much of the researcher's time must be spent in acquiring a basic understanding of the problem. It is hoped that this thesis will simplify this initial step, thereby permitting a more thorough research of topics bearing on the BEMAR problem.

The fourth objective will be to review BEMAR as an indicator of real property condition.

1.3 Significance

The significance of the BEMAR problem was indicated in 1.1 above; i.e., "The projected Navy BEMAR for the end of fiscal year 1971 is $282 million or about eight times the target (¼% of CPV)." It can be seen that if BEMAR is a valid indicator of real property condition and if ¼% of CPV is the target desired, being eight times off target is a significant problem. Since BEMAR is the backlog of major essential maintenance and repair projects, an appreciation of the magnitude and complexity of the Navy plant is desirable. Excerpts from a Naval Facilities Engineering Command (NAVFAC) "briefing paper" will provide this appreciation:

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[1] The author anticipates that Navy Civil Engineer Corps Officers attending the University of Pittsburgh will persue the "dual degree program" of Master of Public Works/Master of Science in Civil Engineering.

> "The annual expenditure involved in the maintenance program is $467.6 million. This money is used to maintain a plant worth almost $25 billion. With 46,700 people involved we maintain over 1,000 activities with more than 639 million square feet of buildings and 4.6 million acres of ground... The 639 million square feet of buildings involved is the equivalent of 300 Empire State buildings... The 4.6 million acres of ground about equal to the area of the State of New Jersey... If we put the railroad tracks the Navy maintains end-to-end, they would traverse the United States. The water lines would traverse the United States 3½ times and the electrical lines 4½ times... The Navy Shore Establishments comprise a complexity of plant. There are waterfront facilities which handle aircraft carriers and nuclear submarines; airfields for jet aircraft and helicopters; and repair complexes such as Naval shipyards and weapons systems support activities."(79)

1.4 Methodology and Limitations

The author found the information referenced (Bibliography) "scattered" in NAVFAC and DOD.[1] Due to time limitations and the fact that the author found no previous work that attempted to assess the entire BEMAR story, it was necessary to construct this thesis from the many different sources referenced. Unfortunately, many "avenues" having strong influence on the BEMAR problem had to be abandoned/left (after being introduced) for the researchers who will follow.

The remainder of this thesis will contain the

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[1] Command Headquarters of NAVFAC and DOD, Washington, D.C.

following:

Chapter two, BACKGROUND, traces those background items that in the author's opinion have had substantial influence on the BEMAR problem.

Chapter three, CURRENT PLANT VALUE (CPV) AND BEMAR TARGET, examines the role of CPV and target in the BEMAR story.

Chapter four, RATING SYSTEMS-STUDIES. Several attempts have been made to develop and use facility condition evaluation rating systems, and a study has been done concerning the cost of maintenance and repair deferral. This chapter will examine these studies and systems.

Chapter five, BEMAR RELATIONSHIPS. The relationships of various items (recurring maintenance, minor construction, appropriations other than O&MN, etc.) on the BEMAR problem are most confusing. This chapter attempts to order this confusion.

Chapter six through eight, SUMMARY, CONCLUSIONS, RECOMMENDATIONS.

1.5 Special Terminology

Many abbreviations and terms that may be unfamiliar to many readers are used throughout this thesis. Therefore, an Index of Abbreviations and Glossary are considered necessary.

2.0 BACKGROUND

In this chapter the command relationships and group and personal interests affecting the BEMAR problem during the recent past (eight to ten years) will be introduced. In the author's opinion an understanding of command and interest groups influence on BEMAR is essential before problem details can be discussed.

2.1 Single Executive for Real Property Maintenance

In _Review of Management of the Department of the Navy_, 15 December 1962, the following was recommended:

> "Recommendation No. 76- that the Secretary of the Navy assign to a single executive (the Chief of the Bureau of Yards and Docks) the responsibility for maintenance of buildings, grounds, and structures (Class I and Class II property) and the operation of utilities, except for the Marine Corps."[1](80)

Under the recommendation it was conceived that the Chief of the Bureau of Yards and Docks (BUDOCKS) would establish a uniform program for planning, budgeting, funding, staffing, administering, and appraising the maintenance and utilities operation functions. The program would be conducted directly between BUDOCKS and the individual activity commanders, or through regional offices of

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[1] The Chief of the Bureau of Yards and Docks (Chief, BUDOCKS) is now called the Commander, Naval Facilities Engineering Command (COMNAVFAC).

BUDOCKS and activity commanders. The allocation of funds to support the maintenance and utilities functions would be administered by BUDOCKS in this same manner.

In support of this recommendation it was pointed out that: the control of maintenance funds and responsibility for facilities maintenance was divided among the bureaus and offices; the backlog of essential maintenance had approximated one percent of the replacement value of facilities for the past seven years, and a more centralized control over the maintenance function should facilitate uniform control of the backlog of essential maintenance in relation to the importance of facilities and the programs that they support.[1]

On 1 April 1963, the Secretary of the Navy directed the Chief, BUDOCKS to take such actions as were required to assume full responsibility for execution of the facilities maintenance and utilities operation functions effective 1 July 1963.(81)

In a presentation delivered at the NAVFAC and EFD Maintenance Conference,[2] September 1966, Cdr. Timberlake

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[1]Other justification for "Recommendation 76" included: resistance by activities and bureaus to public works consolidations, need for more aggressive implementation of the controlled maintenance program, and the need to assure the Congress that the Navy is responsive to Congress's concern over the diversion of maintenance funds to other uses.

[2]Engineering Field Division (EFD) is a geographically located field office of NAVFAC. EFD was formally called Bureau Field Division (BFD).

discussed the philosophies developed by NAVFAC resulting from the increasing responsibilities in the Navy's shore installations, and solicited support in retaining these systems under the DOD Resources Management System (RMS).[1](82) He listed some basic philosophies for facilities management:

"-Land and improvements represent large capital investment
-The investment can be justified only from basis of valid military requirements
-So long as investment is justified, facilities management must be designed to:
.Protect the capital investment
.Modernize the plant as economy, obsolescence, and technology dictate
.Provide for new requirements
.Supply optimum operational support"(83)

He then listed what he called certain corollaries derived from the foregoing basic philosophies:

".Real property has a life of its own
.Investment in real property is seldom oriented to a sole user
.Real property serves several users--simultaneously or consecutively--and all require many common services
.Identities, missions, and functions of real property users change the nature of facilities management, but not its substance
.Users and their missions can and do change, but the property remains, to be modified and adapted as required
.Maintenance management efforts are preponderantly a function of occupancy or vacancy--not of level of activity
.Operations management efforts (Utilities consumption, transportation requirements, janitorial services, trash and garbage collections) are reflective of perceptible changes in tempo"(84)

---

[1] See 2.? for information concerning RMS.

Mr. Timberlake noted that before the single executive designation the ten independent bureaus and offices were free to pursue facilities management systems application according to their own customs and habits; that some were vigorous, while others were indifferent, but that in either instance there was no centralized authority to exercise system discipline or to evaluate relative need.(65)

He pointed out that under single executive designation facilities system design and implementation accelerated. The majority of commanding officers, and most bureaus, commands, and offices were just beginning to accept and respect the single manager concept. In May 1966 the Auditor General of the Navy concluded an investigation of many month's duration into the impact of the single executive designation. Among his findings appear these words:

> "Physical maintenance has improved under BUDOCKS's direction... The division of fund and personnel ceiling control has not impaired operational control of the activity... The visits of the BDO Management Assistance Teams have materially reduced maintenance management problems... Although commanding officers' opinions are divided, the majority concludes that the allotting of maintenance funds by the BDO vice the individual management bureaus has resulted in a more equitable distribution and a better maintained shore establishment."(66)

In Mr. Timberlake's words, "The advent of the DOD Resources Management System threatens the concept of a single manager."(67) If single executive managership

is to reach its full potential, then: responsibility must remain with a single individual, management must be centralized, funds must be centrally controlled, information systems must be centrally designed and used, and execution must be decentralized to field divisions of the single executive.(88)

2.2 Resources Management System

The DOD Resources Management System (RMS), implemented on 1 July 1967, consists of four interrelated subsystems:

"1. Programming and budgeting
2. Management of resources for operating units
3. Management of inventory and similar assets
4. Management of acquisition, use, and disposition of capital assests."(89)

The programming and budgeting systems focus on the goals, purposes and outputs of the Department of Defense, array alternatives together to sharpen the decision-making process, and display constituent parts in such a way that responsibility can easily be identified. The systems for management of resources of operating units focus on outputs and on resources used, focus on managers who are responsible for effective and efficient utilization of resources, focus on actual performance in relation to planned performance, and use expense operating budgets and accounting as a primary means of management and financial control at each organizational level.

Due to the magnitude of item 2. above[1] and to improve the management of resources, the Navy and Marine Corps on 1 July 1968 implemented Project PRIME (Priority Management Effort) which provides such uniform concepts as:

> "Accrual Accounting, by which an activity is charged for resources at the time they are consumed.
>
> Total Costing of an activity, whereby all costs of an activity are managed, including such diversified costs as military personnel, POL, and minor construction.
>
> Work Units may be assigned to the smallest increments of an activity. These work units become part of the annual budget (plan) and are reported monthly by the performing offices."2(90)

In his article, "Planning-Programming-Budgeting Systems and Project PRIME", Lieutenant Commander Lazarus concludes that:

> "Project PRIME means that the manager's flexibility in deciding on what resources to use should be increased. He should be encouraged to think about, for example, the best balance between military personnel, civilian personnel and contract personnel, or the optimum degree of mechanization, in a wide variety of situations. With the financial segregations that now exist, managers have little incentive for investigating such alternatives."(91)

However, it was this financial segregation of facilities dollars that permitted NAVFAC as single executive to manage facilities as an integrated system in themselves.

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[1] In fiscal year 1969, 12.1 billion dollars, or approximately 50% of the Navy and Marine Corps budgets was spent on management of resources.

[2] POL refers to petroleum, oil and lubricants.

The implementation of RMS through project [illegible] has removed NAVFAC as the single executive for facilities management functions. In accordance with OPNAV Instruction 11010.23B,[1] (92) commanding officers now have the flexibility to apply facilities management resources other than those constrained by the Congress, to other functions as conditions require:

> "(a) There is no longer a "fence" around funds for facilities management. The statutory maintenance "floor" (see 2.41 below) is the only restriction on claimants[2] with respect to execution of facilities management funds.
>
> (b) Chief of Naval Operations (CNO) control figures for facilities management are planning figures for budget purposes and do not constitute a constraint upon claimants in execution.
>
> (c) CNO has final decision with respect to fund distribution to claimants.
>
> (d) Claimants have the flexibility to adjust funding levels, exclusive of the statutory maintenance "floor", during the apportionment process.
>
> (e) NAVFAC and its field activities are tasked to provide expert advice and assistance to command in the facilities management area and should be used in lieu of building up duplicate staffs for this purpose."(93)

2.3 Single Executive-RMS Differences and Current Command Relationships

Under the single executive concept, funding flow for facilities management was from the Navy Comptroller

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[1] Office of the Chief of Naval Operations (OPNAV).

[2] Refers to major claimants. See Figures 2 and 3 and the Glossary.

to NAVFAC, from NAVFAC to the Engineering Field Division (EFD), and from the EFD to the activity. It was necessary for the commanding officer to justify against the background of the resources already made available to him any request for additional funds. From its Navy-wide overview, NAVFAC was able, by applying the functional and unit cost principle,[1] to determine a fair share of available resources for each activity based on its needs.(94) There was much opposition to this method of resource allocation. This conflict apparently results from a difference of viewpoint as to the purpose of facilities. The commanding officer views facilities as another resource to be used in support of his mission. Operations receive priority in financing with facilities receiving the "left-overs."[2] As stated under 2.1 above, NAVFAC as single executive viewed facility maintenance management efforts as preponderantly a function of occupancy or vacancy; not of level of activity.

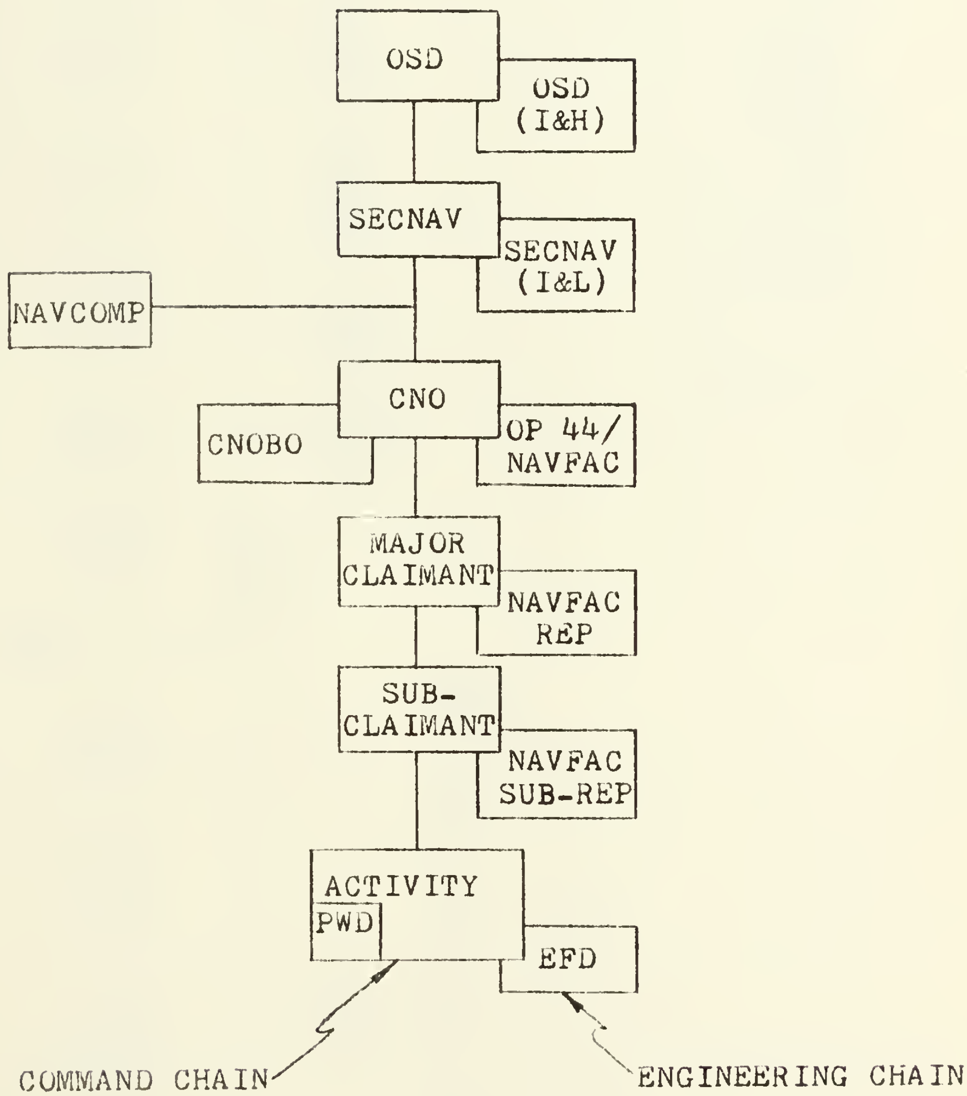
Under RMS, funds are "channeled" along the same lines as command (Figures 2 & 3). Most commands are now able for the first time to budget, account, report, and manage all command resources in one operating budget, with but one limitation, the maintenance "floor".(95)

---

[1] Techniques for allocation of facilities management resources will be discussed under 3.121.

[2] Congressional comment regarding this is under 2.41.

THE MANAGERS[96]



Note: refer to Glossary and
Index of Abbreviations

FIGURE 2

UNILINEAR NAVY[97]
(COMMAND/RESOURCES)

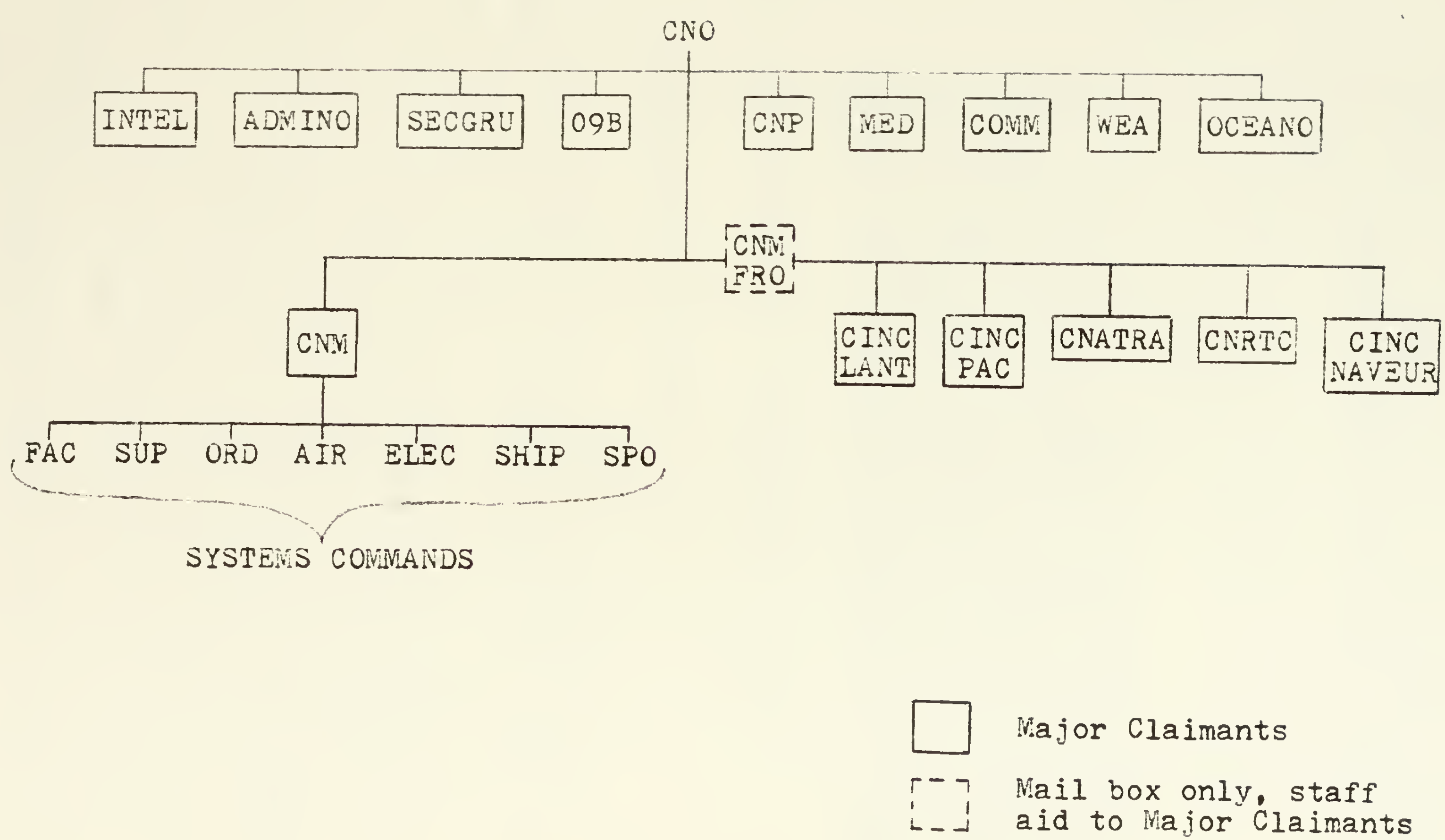


FIGURE 3

NAVFAC and its field activities provide advice and assistance (engineering "chain") in the facilities management area and the commanding officer can either accept or reject this advice.

In a briefing of the Secretary of the Navy, Vice Admiral Shifley[1] pointed out:

> "... during 1963-65, when maintenance management was centralized in NAVFAC, about $30 million per year from the maintenance floor was devoted to the major repair work included in the backlog of essential maintenance. During this time backlog remained high, but fairly steady. Since funding and management have been transfered to major claimants, however, the backlog has risen steeply, bacause smaller percentages of maintenance funds were used for major repair work."[2] (98)

2.4 Congressional and Executive Interest

2.41 Congressional Interest

The Congress has shown its concern for the maintenance of facilities on several occasions. Some examples of this concern follow.

(A) In House Report 1607, 87th. Congress, it was reported that new appropriation accounts set up specifically to identify and differentiate funds appropriated for the maintenance of real property facilities were included in the DOD Appropriation Bill.(99) Transfers would be permitted into these accounts but not permitted

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[1] Vice Admiral Shifley was Deputy Chief of Naval Operations (Logistics).

[2] See 5.11 and Figure 5.

out. In defense of this action the Committee stated:

> "Some may argue that this is an unwarranted action; however, the Committee has felt for years that operations were being financed, whether essential or not, at the expense of funds intended to be made available for maintaining the physical plant."(100)

The Committee continued with a quote from its own report, House Report 1830, 85th. Congress, p. 17:

> "However, the Committee is greatly concerned about the long range effects of deferred preventive maintenance over the last few years. Service field commanders are inclined to neglect this area of preventive maintenance when funds are a little tight. The Committee has provided all funds requested for such maintenance and insists that the work be done. The Secretary of Defense should see that this preventive maintenance, designed to prolong the life of facilities, is carried out as budgeted, even if it requires making special allotments to field commanders for this purpose. Under no circumstances are these funds for preventive maintenance to be diverted to other uses."(101)

The Committee revealed its consideration of the question of the flexibility of managers by stating:

> "Some may say that the proposed creation of two appropriations where one existed before is an intrusion on the flexibility so essential to good management. The Committee can but point to the sorry condition of so many Federal properties..."(102)

Upon final passage of the 1963 DOD Appropriation Act, instead of two separate appropriations, maintenance of real property facilities costs were retained under the Operation and Maintenance Appropriations in an amount which shall be the minimum available, called the maintenance "floor". This "floor" has accomplished what the separate appropriation would have accomplished without

the undue restrictions that separate appropriations would have caused, i.e., funds can be transfered into the "floor" (but not out) with little administrative effort.

(B) In House Report 439, 88th. Congress, the Committee demonstrated its continued interest in the maintenance of real property facilities by reporting:

> "It will be noted that although the Committee has reduced the 1964 budget request of the Navy, it has not reduced the minimum of $134,500,000 which shall be available for the maintenance of real property facilities... In view of what appears to be a rather severe reduction in maintenance funds, it is the opinion of the Committee that additional funding to the greatest extent possible should be applied by the Navy to the maintenance of real property facilities during the 1964 fiscal year."(103)

As shown in Figure 4, the Navy has funded in excess of the statutory maintenance "floor". This has been accomplished by "migrating" funds from other areas of the Operations and Maintenance (O & M) Appropriation into the "floor".[1]

(C) In an article titled "Military Construction Appropriations, Are We Planning Right and Building Enough?", Congressman Robert L.F. Sikes[2] discussed maintenance neglect.(104) He discussed much of that noted in (A) and (B) above and cited an incident concerning

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[1] See 5.1 for discussion of the O & M and other appropriations.

[2] Congressman Sikes is Chairman, Subcommittee on Military Construction, House Committee on Appropriations, U.S. Congress.

STATUTORY MAINTENANCE FLOOR
VS
ACTUAL FLOOR FUNDING[105]
(NAVY ONLY)

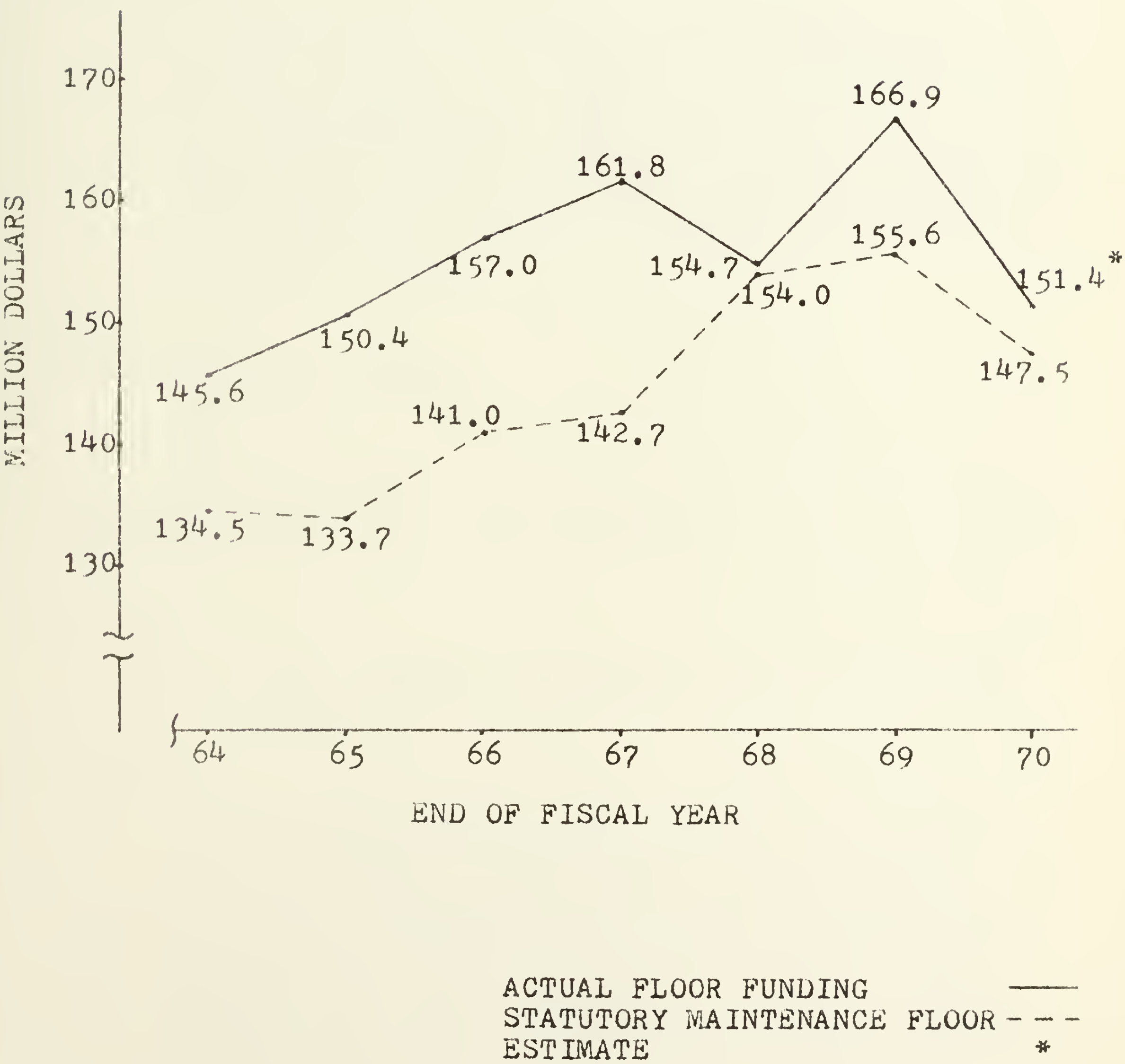

FIGURE 4

the fiscal year 1969 appropriations wherein reductions were made in the "floors" on real property maintenance by the executive branch. Congressman Sikes called this a situation of ignoring, or violating, congressional intent resulting in aggravation of the problem of deferred maintenance. He concluded his comments on maintenance with:

> "I do not wish to magnify this incident out of all proportion. I stress it only to show the strong interest of Congress in an adequate level of maintenance. When this is not done, it is safe to say that the taxpayers of the country have to shoulder the burden of new construction prematurely or unnecessarily because of failure to adequately maintain facilities that are now in being."(106)

2.42 Executive Interest

The following demonstrate the "high level" executive interest given the maintenance backlog in recent years.

(A) In a NAVFAC memorandum the following was written:

> "During the briefing in the SECNAV MIC on 23 November, Mr. Nitze stated that Mr. McNamara had previously accepted the desirability of reducing the backlog of essential maintenance not only to the one quarter of 1% of PRV level but even lower than that. The only question open is the time at which additional funds will start to be applied to reduce the backlog. Obviously, during the current war situation, there are higher priority needs, but the fact

that we are not getting enough funds now should not prevent our requesting them in the future."1(107)

(B) In a "Memorandum for the President", the Secretary of Defense, Mr. Laird, on 17 October 1969, stated:

"Keeping our real property investment in good condition is a real problem. The current backlog of essential maintenance and repair exceeds $650 million, considerably more than funds annually available for that purpose. We hope to whittle down this backlog by more scientifically determining the condition of our real property so as to improve the planning, programming, budgeting, funding and analysis of maintenance organization, workload and costs. Our long range goal is to reduce this backlog to a manageable level of about $200 million."(108)

Mr. Laird noted that the Department of Defense is the world's biggest landlord with forces occupying about 1,000 major and 11,500 minor military installations throughout the world, with 31 million acres of land valued at $40 billion.

(C) The Logistics Performance Measurement and Evaluation System (LPMES) was established by the DOD as a uniform system for measuring and evaluating specific logistics functional areas to ensure that the DOD is achieving the most effective and efficient use possible of logistics resources.(109) "The objective of the System is to concentrate management improvement actions on

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[1] Mr. Nitze was Secretary of the Navy (SECNAV) and Mr. McNamara Secretary of Defense at this time (23 November 1966). MIC means Management Information Center. Plant Replacement Value (PRV) is now called Current Plant Value (CPV).

persistent problem areas by establishing performance objectives and evaluating performance against these objectives in areas where current progress is substantially below that desired."(110) It is interesting to note that BEMAR was selected as one of the original 20 functional areas. The ultimate goal established under LPMES is to reduce BEMAR to a manageable level by fiscal year 1975.(111) It was learned through interviews at NAVFAC, that no results have been achieved toward BEMAR reduction through LPMES since the reports are not submitted for, or to, a point of decision for BEMAR funding adjustment.(112) In an article about LPMES, Donald Noble reports that the LPMES program director has stated that Secretaries Laird and Packard have shown great personal interest in the first two reports and the program's progress.(113) Perhaps consistant lack of progress toward the BEMAR goal will get "point of decision" attention as the LPMES matures.

2.5 Real Property Maintenance Council

The Real Property Maintenance Council,[1] under the auspices of the Office of the Assistant Secretary of Defense (Installations & Logistics), chaired by the Director of the Real Property Directorate, meets once a month to discuss items of common interest to DOD

[1] The Council was established in 1962.

components in the real property maintenance area. The "Real Property Maintenance Goals for Improved Management," adopted by the Real Property Maintenance Council are listed in Appendix B. The work of this council will be referenced in subsequent sections of this thesis.

2.6 Real Property Maintenance Management Conferences

There have been two Defense Real Property Maintenance Management Conferences (23-25 September 1964, and 16-18 December 1969) sponsored by Assistant Secretaries (Installations and Logistics) of Defense and the Military Departments. The significance of these conferences can be noted from the "top level" personnel in attendance: 135 (1964) and 114 (1969) full time and part-time conferees in addition to the conference staffs. For both conferences approximately one-third of the conferees were general or flag officers and their civilian equivalents from the Office of the Secretary of Defense (OSD), DOD Components, other Government Agencies and Industry. Objectives for both conferences were:

> "1. To define and analyze the principle problems that confront the DOD in the field of Real Property Maintenance.
>
> 2. To exchange ideas on solution of these problems.
>
> 3. To recommend to the executive levels of the Office of the Secretary of Defense and the Military Departments appropriate actions that will result in more efficient and economical

management of real property maintenance."(114)(115) The recommendations resulting from these conferences will be referenced in subsequent sections of this thesis.

2.7 Summary

Before the Naval Facilities Engineering Command (NAVFAC) was installed as the single executive for real property maintenance there was no centralized authority to exercise system discipline or to evaluate relative need in the real property maintenance areas. During its term as single executive, NAVFAC did have centralized authority for both budgeting and fund allocation in the real property area and developed techniques to evaluate relative need. There was considerable objection to this centralized authority. Now under the Resources Management System (RMS), NAVFAC provides advice and technical assistance to command. The Chief of Naval Operations functions as the single executive, utilizing NAVFAC's expertise in the evaluation of facility maintenance requirements. Under this new system the rate of BEMA increase has accelerated.

The conflict over purpose of facilities was raised. Commanding officers view facilities as another resource to use in support of their missions while others view facility maintenance management efforts as preponderantly a function of occupancy or vacancy; not of level

of activity (real property has a life of its own).

Congress showed its concern regarding maintenance deferral and instituted the maintenance "floor". Top DOD executives have resolved to reduce the BEMAR, yet backlog continues to increase.

Subsequent chapters will examine the efforts that have been made to devise methods of allocating real property maintenance resources, discuss the apparent conflicts and contradictions bearing on the BEMAR problem, and attempt to recommend "avenues" of approach to better evaluation of maintenance backlog.

3.0 CURRENT PLANT VALUE (CPV) AND BEMAR TARGET

This chapter will provide the rationale for the use of Current Plant Value (CPV) as a common denominator in evaluating maintenance performance and for the establishment of BEMAR target as ¼% of CPV. Uses of CPV and BEMAR will be discussed.

3.1 CPV Determination and Use

In an address at the Defense Real Property Maintenance Management Conference,[1] September 1964, Rear Admiral Corradi, Chief of the Bureau of Yards and Docks stated:

> "In reviewing the overall management concepts as applied in the Department of Defense for real property maintenance, I have concluded that one of the major problems confronting us today is the problem of comparability. An analysis of effective management of the real property maintenance function cannot be realistically made between the services unless there is some type of a common denominator. The development of a common denominator for application of evaluating performance of real property maintenance will go a long way in providing for effective management. In my opinion the use of plant replacement value (PRV) as a common denominator for departmental comparisons will provide a basis for solving the problem of comparability."[2] (116)

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[1] There have been two "top management" Defense Real Property Maintenance Management Conferences (see 2.6); 1964 and 1969.

[2] The term plant replacement value (PRV) has been replaced by current plant value (CPV).

He gave examples of how the Navy uses CPV to determine resource requirements and as an aid in resource allocation decisions. Before discussing these uses some statements will be made of how CPV is obtained.

3.11 Marshal Stevens Index and CPV

The Marshall Stevens Index (MSI)[117] is used in determining a replacement cost factor. The MSI and similar indices are used for real estate valuation and depreciation work and are the basis for most real estate tax bases, insurance computation, etc.[118] The MSI building indices (updated quarterly) are computed for three separate areas of the U.S. (Eastern, Central, and Western) and for four types of construction: fireproofed steel frame, reinforced concrete, masonary bearing walls, and open frame steel or wood. These indices, when multiplied by the building acquisition cost, provide a replacement cost that represents the total cost of construction required to replace the building with a substitute of like utility. These costs include labor, materials, supervision, constructor's profit and overhead, architect's plans and specifications, taxes and insurance.

Annually, NAVFAC prepares a conversion table, using the average of indices for Eastern and Western districts, and combining fireproofed steel frame and reinforced concrete to represent permanent construction,

masonry bearing walls to represent semi-permanent, and open frame steel or wood to represent temporary. Examples of the resulting replacement cost factors for May 1969 follow:(119)

Year Built	Type of Construction		
	Permanent	Semi-permanent	Temporary
1901	7.983	9.666	9.429
1925	4.291	4.363	4.502
1945	3.026	3.010	3.048
1959	1.342	1.369	1.397
1969	1.000	1.000	1.000

These factors are applied world-wide.

The MSI was chosen in 1956. It was selected because the office of the Assistant Secretary of the Navy for Installations and Logistics was using it then, and all other things being equal, it was considered desirable to adopt this service.(120)(121) In Real Property Maintenance Fact Sheets, NAVFAC discussed MSI and similar indices:

> "1. There are other similar indices of broad coverage available. The Turner Construction Co. index is based on Eastern U.S. contracts and considers labor rates, material prices, productivity of labor, efficiency of plant and management, and competitive conditions. Engineering News Record publishes two indices, one for heavy construction and one for buildings. Each index uses costs of structural steel shapes, cement, and lumber. The construction index adds common labor while the building index adds skilled labor. These ENR indices measure wage and material price trends and are not adjusted for labor productivity, efficiency of management, competitive conditions or other factors affecting construction costs. The indices of E.H. Boeckh and Associates are published for many separate

cities and distinguish between two or more types of construction material within each of three classes of buildings; (a) residences, (b) apartments, hotels and offices, and (c) commercial construction.

2. Plotting of these four indices over the past 50 years shows the following relative increases in construction costs:

	Times Increase in 50 Years
ENR Construction	9.3
Buildings	6.1
Turner Construction Co.	6.4
E.H. Boeckh & Assoc. (Residences)	5.5
Marshall and Stevens Co.	5.9

The Marshall-Stevens index thus indicates a conservative increase and at the same time includes consideration of factors not included in other indices."(122)

3.12 Justification of CPV in Comparability Uses

Several studies have been conducted to determine the most significant factor affecting real property maintenance resource requirements. Results of the studies reviewed by the author are discussed.

(A) In a study completed by a BUDOCKS task group in January 1964 the following was reported:

"Replacement cost valuations recorded in the inventory provide the only measurement applicable and available for all category codes. Up-dated annually, this indicator is a practical common denominator for comparing two or more facilities or activities because it has been factored for age, location, and type of construction.

On the other hand, acquisition costs are applicable only to two or more things constructed at the same time. Square footage is equally

> deficient because many facilities in the inventory are not recorded in terms of square footage."(123)

In addition, the study concluded that a category code-replacement value approach was applicable for activity budgeting. This approach was compared with actual experience at 43 activities for a three year period. The average variation of actual from expected was ten percent.

(B) In <u>A Brochure of the Real Property Maintenance Situation of the Naval Shore Establishment</u>, May 1964, it was reported that:

> "A second and independent study was completed in the Bureau in early April 1964. This study was a statistical analysis which indicated that real property maintenance requirements grow in direct proportion to plant replacement value. Indices indicating the relationship between maintenance costs and plant replacement value were developed based on Navy-wide statistics. The study concluded that such indices were valid for Navy-wide applications but that slight variances could be expected at the activity/command level. This study did, however, demonstrate that the data obtained from analysis of 120 activities correlated to an acceptable degree with actual activity level experience."1(124)

(C) In <u>Research Report on Development Of Basis for Allocating Maintenance Resources</u>, July 1964, Battelle Memorial Institute reported the results of research to investigate various factors affecting real property maintenance cost, and determine those factors having the more significant effect.(125) Data from 134 activities

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[1] The author could not locate the study referenced in the quotation.

were analyzed,[1] considering economic, geographic, climatic, organizational, and operational factors and measurements, to estimate their influence on maintenance fund and manpower requirements. The study indicates that replacement value is the most significant factor affecting real property maintenance requirements, and that there is a high order of correlation (90%) between those two factors at the activity level.[2]

(D) In <u>An Evaluation, Study, and Test of a System for Facility Condition Evaluation</u>, Technical Services Corporation reported in June 1966:

> "Since it is desirable that the repair cost of a component be the dominant factor in the Component Condition, a means of comparison had to be employed to relate repair cost to condition. Ideally, the replacement cost of the component would be the comparative measure. Dividing the repair cost by the replacement cost in hundreds of dollars would yield an absolute percentage of Component Condition."(126)

Additional comments regarding this study are made under 4.32.

(E) During the time period of (D) above, the Navy performed a similar study concerning facility condition evaluation. In their report of a test of an alternate system, NAVFAC reported:

> "It was logically concluded that the dollar value of facility deficiencies should serve as the

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[1] Correlation regression analysis.

[2] However, other factors with "high order" correlation to maintenance requirements were reported: total personnel on board, floor area in buildings, and civilian personnel on board.

> basis for an evaluation system. This offers the potential use of several relationships or factors for analyses. These include relating value of deficiencies to funding levels or plant value. Relating the dollar value to deficiencies found by inspection to the plant replacement value of the facility was utilized in the alternate evaluation of several facilities. It was considered that this provided the best available common denominator to reflect the condition or maintenance requirements to the size of the plant being maintained... The elements of described and priced out deficiencies and PRV offer potential for use in establishing priorities of accomplishment at local levels, budgeting, and distribution of funds."(127)

It can be seen from the above that CPV through the use of the Marshall Stevens Index is claimed to recognize size, age, growth and other significant characteristics of the plant property being maintained; that CPV provides the most objective basis for analyzing changes in required maintenance support.(128)

3.121 Some Specific Uses of CPV. Use of CPV for evaluation of performance of real property maintenance was claimed in 3.12 above. Specific uses of CPV follow:

(A) NAVFAC uses CPV, backlog, and Real Property Maintenance Activities[1] expenditures to compute ratios for service-wide comparison purposes:(129)

	Army	Navy & Marine	Air Force	Average
$\frac{\text{Backlog}}{\text{CPV}}$	0.00755	0.01326	0.00519	0.0081
$\frac{\text{Expenditures}}{\text{CPV}}$	0.02597	0.02262	0.02301	0.02392

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[1] See 5.12 for a discussion of Real Property Maintenance Activities (RPMA),

(B) During the period when NAVFAC was the single executive for real property maintenance (see 2.1), both budgeting and fund allocation was a NAVFAC responsibility and CPV and backlog data were utilized in the development of uniform activity equitable distribution of maintenance resources. Now that the funding "chain" (see 2.3), is through the claimant and not the EFD, NAVFAC and NAVFAC Sub-reps advise claimants in the area of maintenance resource allocation, and uniform allocation is no longer possible.(130) However, the techniques developed by NAVFAC while single executive are utilized in providing advise on the budgeting for and distribution of maintenance resources. Current Plant Value and backlog data are used for planning and budgeting for both recurring maintenance and projects over $10,000. For example, some functions and facilities (fueling facilities, training structures, etc.) cannot be measured by a physical unit of measure such as square feet, linear feet, etc., and CPV is used as a unit of measure for these.(131) In order to recommend distribution of maintenance and repair project dollars over $10,000 the following are used:

$$\$ \text{ for } \left\{\begin{matrix}\text{Claimant}\\ \text{Repair}\\ \text{Projects}\\ \text{over } \$10{,}000\end{matrix}\right. = \frac{\frac{\text{BEMAR}}{\text{CPV}}(\text{Claimant})}{\frac{\text{BEMAR}}{\text{CPV}}(\text{Navy})} \times \frac{\text{BEMAR (Claimant)}}{\text{BEMAR (Navy)}} \times \$\begin{matrix}\text{Available}\\ \text{Navy-wide}\end{matrix}$$

$$\text{Condition} = \frac{\text{Unfunded Facilities Deficiencies}^{1}}{\text{CPV}}$$

3.13 Real Property Maintenance Council Effort to Standardize Determination of CPV

In 3.1 above, Rear Admiral Corradi stated: "An analysis of effective management of the real property maintenance function cannot be realistically made between the services unless there is some type of common denominator."(132) In their principal conclusions and recommendations the conferees of the 1964 Defense Real Property Maintenance Management Conference concluded: "The need for the Congress and the DOD to have some common denominator for measuring effectiveness and adequacy of maintenance across the services is recognized."(133) The conferees recommended further study in this area.

The Working Group on Budgetary and Comparison Recommendations of the Airlie[2] Conference initiated a

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[1] Unfunded facilities deficiencies include: BEMAR (backlog over $10,000) and BEMM (backlog less than $10,000).

[2] Both Defense Real Property Maintenance Management Conferences (1964 and 1969) are referred to by many as the Airlie Conferences. "Airlie" refers to the Airlie House; the location of the conference meetings in Warrenton, Virginia.

study in May 1965 to develop a uniform method of determining replacement costs of military real property for use by each of the three services. During the meetings that followed, each of the services presented their systems of determining replacement value, and several compromise proposals were studied. In a memorandum for the record (MFR) that concluded this study the following is of interest:

> "Each of the three military departments presently has a method which is currently used to determine updated inventory values for internal use within the department. An informal comparison of these various methods of computation was accomplished under the auspices of the Navy during the fall of 1965. In gross, the results were relatively close, but wide variations were revealed in some of the three-digit categories. These variations minimized the significance which could be attached to the gross results."(134)

The MFR concluded that due to the magnitude of the generalizations and assumptions required to test a system of CPV, the end result would not justify the time and effort required. Therefore, the subject of development of a uniform method of real property replacement cost determination, CPV, was dropped.

3.2 BEMAR Target

3.21 Why Target of ¼% of CPV

The author sought an explicit rationale for the establishment of target backlog as ¼% of CPV. It is stated in SECNAV Instruction 11010.5A that: "A backlog

not in excess of $\frac{1}{4}$ of 1% of Plant Value represents a generally acceptable plant condition."(135) In a NAVFAC "point paper" it is stated:

> "The Assistant Secretary of Defense (Installations and Logistics) assigned to the Logistics Management Institute (LMI) the task (SD-271-29 of 19 November 1965) to assist the Office of the Assistant Secretary of Defense (I & L) to develop key Logistics Program Management indices as an aid to OSD top managers. The Logistics Management Institute in response to the task order developed a number of indices as related to Real Property Management. Among these was the ratio of plant condition to plant value with a goal for this ratio of one quarter of 1% of plant value. This is the ratio widely accepted by industry and confirmed by NAVFAC engineers as being the point at which the Navy will achieve the optimum level of maintenance and of mission support for the dollars being spent."(136)

Efforts to determine the rationale used by Logistics Management Institute in setting the $\frac{1}{4}$% target and stating: "This is the ratio widely accepted by industry..." failed. However, supporting information for the $\frac{1}{4}$% target being confirmed by NAVFAC engineers was located. In <u>Real Property Maintenance Fact Sheets</u>, May 1964, NAVFAC stated: "... it has been determined that this new annual backlog input has been 0.0025 ($\frac{1}{4}$ of 1%) of PRV."(137) In other words, if the BEMAR target of $\frac{1}{4}$% of CPV were to be achieved and maintained, all essential maintenance items generated during one year would be accomplished during the following year.(138) From various interviews with DOD(139) and NAVFAC[1](140)(141) personnel this

[1] Several other interviews confirmed this but have not been cited.

concept of the rationale for the BEMAR target of ¼% of CPV was confirmed. Several of the statements used to describe this concept of annual backlog input of ¼% of CPV are: "about one year's backlog growth," "managable level," "yearly rate of CPV deterioration," "an operating backlog," "annual generation of major repair," "equates backlog to annual generation and therefore we would never have more than one year delay from need identification to work accomplishment."

A panel of the second Defense Real Property Maintenance Management Conference concluded: "The criteria established by the Navy as '¼ of 1% of Current Plant Value' could be a goal for backlog reduction, and be useful in setting a realistic floor."(142)

3.22 Target and Policy

The fact that the BEMAR target has been accepted at top management levels was shown under 2.42. However, as shown in Figure 1, BEMAR continues to grow. Since the implementation of RMS in 1967, the rate of growth has accelerated and no elimination of backlog or even a "tapering off" of growth in the near future is a apparent. The various goals set over the years for backlog reduction have not been met. The LPMES goal (see 2.42) appears to have little chance of being met (or even approached). Some insight into the reasons for this failure is required.

A Defense Real Property Maintenance Management Conference panel concluded:

> "... BEMAR (Backlog of Essential Maintenance and Repair) has lost its credibility, and as currently structured does not represent the total maintenance backlog or deficiency. The result of this credibility loss has been seen primarily in adverse budget actions of OSD (Comptroller) and the Bureau of the Budget... BEMAR--as a term or a system--should be recast and restated. Special efforts will be required to have it fully understood and accepted at both Service and OSD level, in order to permit useful budget action and review."(143)

This loss of credibility of BEMAR was discussed in interviews.(144)(145) Some of the possible reasons given for this credibility loss were:

(a) The BEMAR is rising with no apparent adverse effects, thereby indicating an overstatement of needs.

(b) There can be no such thing as an essential maintenance deficiency under the unlinear Navy concept.

(c) For any level of funding, the services will fund the essential items, and therefore there can be no such thing as BEMAR, by definition.

Before discussing these opinions for credibility loss, essentiality definitions and maintenance goals will be presented.

In DOD Directive 4165.2, Objectives and Policies Relating to the Real Propety Maintenance and Utilities Operation Program, one of the program objectives stated is:

"To maintain in the most economical manner all active real property to a standard which will prevent deterioration beyond normal wear and tear, and inactive facilities to a standard commensurate with reactivation requirements."(146)

Further guidance was given under standards of maintenance:

"Facilities to be used more than ten years will be maintained as necessary to preserve the asset and assure its most economical and efficient usefulness for an indefinite period.

Facilities to be used from three to ten years will be given maintenance consistent with the projected useful life of the structure or program to which it is related.

Facilities to be used for less than three years and only to meet a temporary demand shall be maintained to the minimum acceptable standard without jeopardizing the health and safety of personnel or seriously impairing the accomplishment of the mission.

Inactive facilities in mobilization plans will be maintained to the extent necessary to insure weather tightness, structural soundness, protection against fire and erosion, and as necessary to permit reactivation in the period prescribed. Lay-up measures as appropriate for proper protection of the property will be applied to these facilities."(147)

In other DOD Directives and Instructions,[1] the military departments have been charged with the responsibility of establishing their individual policies and objectives related to and consistent with these basic DOD policies and objectives. The services are instructed to take into

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[1] No attempt will be made in this thesis to evaluate all DOD and service maintenance policy. Only that policy necessary to indicate the broad guidance by DOD, and illustrate some of the problems encountered by the services in carrying out that policy, will be given.

account operational experience and establish policies and objectives in order to establish cooperative relationships and lead to sound management decisions at each organizational level.(148)

It appears obvious from the foregoing that the Navy's task in carrying out DOD's policy would be difficult. Numerous instructions and manuals have been issued by NAVFAC to aid in carrying out their maintenance responsibilities. A partial list of publications and instructions is contained in Appendix C.[1]

Examples of NAVFAC's efforts in interpreting the broad purpose of maintenance were given in 2.1; "real property has a life of its own... identities, missions, and functions of real peoperty users change the nature of facilities management, but not its substance... maintenance management efforts are preponderantly a function of occupancy or vacancy--not of level of activity." It was seen under 2.3 that a conflict exists over the purpose of facilities: "Commanding officers view facilities as another resource to use in support of their missions..." In the publication, Maintenance Management of Public Works and Public Utilities, NAVFAC states:

> "Because of the international situation, active as well as inactive facilities have to be

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[1] It is emphasized that Appendix C is only a partial list. It could be argued that nearly everything that NAVFAC publishes bears on their efforts to carry out the broad DOD guidance.

> maintained for an indefinite period in varied states of readiness. The standard of maintenance throughout the Department of the Navy must be such that existing facilities will withstand the period of neglect that inevitably occurs after mobilization, because priorities for men and materials are assigned to new construction during this period. For this reason, there must be a uniformly high standard of maintenance to act as a cushion."(149)

Another statement of NAVFAC's real property maintenance policy is to maintain the backlog of deferred maintenance at a level of ¼% of CPV. Still another statement of maintenance policy was made by a panel of the second Defense Real Property Maintenance (RPM) Management Conference:

> "The overriding and significant role of the RPM program should be to assure that facilities meet the commander's requirements for mission readiness. All management systems should be responsive to this primary requirement."(150)

It can be clearly seen that the task of carrying out maintenance policy is made difficult by what appear to be major conflicts of policy intent, i.e., should real property facilities be thought of as having a life of their own or as a consumable for the commanding officers to utilize as he sees fit in carrying out his mission? Should there be a uniformily high standard of maintenance to act as a cushion so that facilities will withstand the period of neglect that occurs after mobilization, or should the overriding role of real property maintenance be to assure that facilities meet the commander's requirements for mission readiness? These

statements are not completely incompatible but they do offer serious conflict to an already difficult task of determining facility condition. To compound the confusion, another element is added to the "ladder" towards maintenance resource allocation decisions-essentiality.

The DOD definition of essentiality is contained within the BEMAR definition:

> "The backlog of essential maintenance and repair consists of those items of maintenance and repair... over $10,000 which cannot be accomplished during the current fiscal year due to lack of resources. An item is considered essential when delay for inclusion in a future program will impair the military readiness and capability, or will cause significant deterioration of real property facilities."(151)

In <u>Inspection for Maintenance of Public Works and Public Utilities</u>, NAVFAC defines essential facilities deficiencies:

> "Deficiency items are considered essential only when sound engineering judgement has determined that they should be accomplished within the current fiscal year. Essentiality is based on the following:
>
> 1. <u>Maintenance and Repair</u>. Corrective action is needed in order that the real property involved may be effectively utilized for its designated purpose.
>
> 2. <u>Facility Replacement</u>. Replacement of the entire facility is more economical than to perform major repair.
>
> 3. <u>Facility Demolition</u>. Demolition of the entire facility is needed to prevent critical fire hazards to other properties, safety hazards to personnel, or to remove facilities no longer required. This includes advertised and negotiated disposal where this procedure would result in the removal of the facility and result in cost saving for the Navy."(152)

Therefore, to an already confusing array of goal implications regarding facility maintenance decisions must be added another conflict: (a) does essentiality mean that delay of accomplishment will impair military readiness and capability (mission aspects) or cause significant deterioration (technical aspects), or (b) does essentiality mean that from an engineering judgement standpoint, considering only the designated purposes of the facility (mission aspects implied, but not specifically stated), deficiency items should be accomplished during the current fiscal year? The difference in essentiality condition appears to coincide with the policy differences, i.e., do real property facilities have a life of their own or should they be considered as consumables in the commanding officer's list of resources available to him for the completion of his mission?

With a somewhat better understanding of essentiality and maintenance goals we can return to reasons for loss of BEMAR credibility.

(A) "The BEMAR is rising with no apparent adverse effects, thereby indicating an overstatement of needs." The DOD definition of essentiality and BEMAR requires impairment of military readiness and capability or significant deterioration of facilities for deficiencies to be essential. Therefore, if there is no proof of such impairment or deterioration (buildings falling down, bridges failing or military missions being

impaired) decision makers will assume that BEMAR is being overstated. Since procedures for the validation of BEMAR projects do not explicitly confirm by any element of the command "chain" other than the commanding officer that the deficiency is of vital military essentiality,(153) it can be assumed (but difficult to prove) that projects not meeting the DOD essentiality criteria will be included in the BEMAR. Also, there is an incentive for the commanding officer to make his backlog as large as possible in the hope of obtaining an increase in his expense operating budget. Under RMS and the unlinear Navy (see 2.3) the commanding officer may expend any increase as he sees fit, i.e., not necessarily on real property maintenance.[1]

(B) "There can be no such thing as an essential maintenance deficiency under the unlinear Navy concept." Those that hold this opinion reason that since the commanding officer receives one "pot of money" (expense operating budget) and he may spend this money any way he sees fit (the maintenance "floor" excepted) then he will fund those maintenance deficiencies that impair his military readiness and capability. If his funds are insufficient for him to complete his mission, then he will certainly let his superiors know of such deficiencies. One fault with this thinking is that the commanding

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[1] Obviously, management reporting systems are in use which will control this occurance to some extent.

officer may disregard his long term maintenance requirements (let his successor worry about it) or he may alter his operations in such a way to accommodate to the deficiencies and thereby spend his resources ineffectively.

(C) "For any level of funding, the services will fund the essential items, and therefore there can be no such thing as BEMAR, by definition." This reason equates to (B) above. Also, this reason is similar to the "time worn" phrase that commanding officers will spend as much as they receive, i.e., there can never be such a thing as too much money.

The discussion of BEMAR target and policy has done little more than raise problems. No solution to the problem of what the target should be has been offered. In subsequent sections, the efforts that have been made to help review the problem of facility condition and BEMAR target with more precision will be discussed.

3.23 Efforts to Standardize Terms and Definitions

The need for the Congress and DOD to have some common denominator for measuring effectiveness and adequacy of maintenance across the services was discussed earlier. It was shown where efforts to standardize the method of CPV determination were unsuccessful. Top managers agree that the backlog of maintenance and repair projects should be recognized by OSD as a key indicator

of adequacy of yearly maintenance and repair funding.[154] Yet, it is seen that the credibility of BEMAR is questioned; that as a term or system it should be recast or restated.[155] Some effort by OSD has been made to establish standard terms and definitions to be used in all facets of the management of real property maintenance activities through a proposed DOD Directive. It is expected that difficulty will be encountered in getting the services' agreement. The Navy in its comments on the proposed directive pointed out that the definitions would change the Navy reporting system and format and would require categorizations of essentiality that the Navy is not structured to apply.[156] In a meeting of the Real Property Maintenance Council[1] that the author attended in August 1970, General Meredith pointed out that it would be one of his first orders of business as Assistant for Real Property Maintenance to settle definitely on the parameters for BEMAR.[157] Should this be accomplished, perhaps some of the confusion over BEMAR target and essentiality will be eased. Some suggestions have been raised that BEMAR should be restated as what is left undone, i.e., the services would list <u>all</u> deficiencies left undone at the time of reporting instead of the present attempt at listing only the essential maintenance and repair projects over $10,000.[158]

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[1] See 2.5.

This would erase the problem of essentiality (for reporting only) and possibly establish the credibility of reporting backlog; however, it is obvious that the determination of essentiality would still be required. This method of reporting backlog may provide a more uniform indication of plant condition.

3.24 How BEMAR is Used by the Office of the Secretary of Defense

In interviews,(159)(160) an attempt was made to gain an insight into how OSD uses BEMAR in determining fund allocation among the services. It was learned that the allotment of O & M funds[1] is based on prior years' funding, manpower allowances, BEMAR, and service use of BEMAR funds. An assumption is made that most of the dollars are spent sensibly and logically. Any areas of weakness receive concentrated evaluation. A key indicator is the demonstration of good (or bad) management practice in the real property maintenance area. BEMAR provides a point of departure; is an indicator. Although the credibility of BEMAR is questioned, it is the only indicator available and will continue to be used until replaced by a better indicator.

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[1] See 5.1 for an account of the full scope of the O & M Appropriation. Maintenance is only a part of these funds.

3.25 Latest Attempt to Reduce BEMAR to Target

In accordance with OASD[1] direction, a program change request was submitted in 1969 that would provide for the orderly, phased maintenance and repair of facilities that would reduce BEMAR to a manageable level by fiscal year 1975. The DOD planned BEMAR for prudent management was established at $33 million (¼% of CPV).(161) Program Change Directive N-9-040 of 20 January 1970 approved with minor exceptions the increased program as an authorized level of expense for real property maintenance if and as the Navy chose to reprogram its funds to that function. The target for BEMAR and the program for reaching that target have been approved, but no funds in addition to that amount already received will be provided, i.e., the Navy is free to reduce BEMAR to target within its available resources. The decision is a "trade off" decision. If the Navy wants BEMAR reduced to target, the Navy must give up something for it (planes, ships, etc. for real property maintenance).

3.3 Summary

This chapter shows: how the Marshall Stevens Index is utilized in determining the Current Plant Value (CPV) of real property facilities; how the use of CPV

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[1] The Office of the Assistant Secretary of Defense (OASD).

was justified and some of the uses of CPV; and discusses the failure of the Real Property Maintenance Council to standardize the procedures for determining CPV throughout the Department of Defense.

The reasons for the establishment of ¼% of CPV as the Backlog of Essential Maintenance and Repair (BEMAR) target are presented. No explicit rationale is apparent for the ¼% target. However, since ¼% of CPV approximates the rate of plant deterioration, and if the ¼% target is achieved and maintained, then deficiencies detected but unfunded in the current year would be funded in the following year, i.e., ¼% of CPV equates backlog to annual generation.

Maintenance policy as it affects BEMAR target is discussed through the presentation of seemingly conflicting definitions of maintenance goals and essentiality. It is seen that BEMAR credibility is questioned. Reasons for this appear to be tied to the conflicts with maintenance goal and essentiality definitions. Efforts now in process to standardize maintenance and repair definitions and terms are presented. If successful, it is hoped that backlog reporting will give decision makers a better indicator of property condition than is possible with BEMAR as presently defined.

It was shown that the latest attempt to reduce BEMAR to target by fiscal year 1975 resulted in no additional funds for this purpose, but did recognize

reduction to target as an authorized level of expense if and as the Navy chooses to reprogram its existing funds to that purpose.

4.0 RATING SYSTEMS-STUDIES

4.1 Introduction

Several attempts have been made to establish rating systems to reflect real property condition, and to rank maintenance, repair and minor construction projects and facilities according to operational priority. The desirability of condition rating and priority ranking systems has long been recognized. To the best of the author's knowledge, the first facility rating and job priority ranking system was recommended in an Albert Raymond and Associates[163] study completed in June 1963. This study covered all DOD Real Property Maintenance Activities[1] with the exception of family housing and pointed out:

> "There currently exists no means for insuring that maintenance forces and funds are being utilized on the most important and most essential work as the year progresses. Further, there currently exists no means for determining whether items appearing as Backlog of Essential Maintenance could have been done in place of other less urgent or less important work... Consequently, relatively less essential work is performed with installation resources while more essential work is deferred pending allocation of additional funds. Improved definitions of essentiality are needed in order to assure that only critically essential projects are included. There should be a way of uniformly considering the relationship of facility type, facility mission and life, and nature of the project."[2](164)

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[1] See 5.12 Real Property Maintenance Activity (RPMA).

[2] Additional comments regarding the Albert Raymond and Associates study are made under 4.2.

In opening remarks before the first Defense Real Property Maintenance Management Conference, September 1964, the Assistant Secretary of Defense (I & L), Thomas D. Morris, stated:

> "We have long needed and given much discussion to means of rating the condition of air bases and installations. We need to perfect and begin using on a current basis such condition measurement ratings. I suspect we have been searching for too much detail and too high a degree of perfection..."(165)

In their principal conclusions and recommendations, however, the conferees concluded: "An industry viewpoint on the impracticality of application of an exact standard measure to compare one installation with another was generaly accepted."(166) Continual study in this area was recommended.

A panel of the second Defense Real Property Maintenance Management Conference, December 1969, recommended:

> "That additional research be sponsored by the OSD to develop facility condition indices which would apply uniformally to the services, and be utilized as a measure of facility condition in addition to BEMAR."(167)

This panel pointed out however: "Because of the difficulties of relating facility use and condition to mission effectiveness, <u>at this time</u>, such priorities must be considered as a relative ranking at the installation level and not as absolute priorities for the comparison between installations, or services at the Headquarters

or DOD level."[168]

The author regrets that only an indication of the extensive work that has been done in attempting to develop a uniform facility condition or facility ranking evaluation system can be presented in this thesis. The evaluation of the systems recommended in the various studies must be the subject of further research. In order to provide an example of the type of systems that have been recommended, results of the Albert Raymond and Associates study will be discussed. The reasons for presenting the Raymond study material instead of other similar studies are:

(a) This is the first such study in this area that the author is aware of;

(b) in the author's opinion, it is representative of the kinds of systems that have been recommended;

(c) it is the only such study that the author is aware of that has been implemented in part (see 4.4); and

(d) it is somewhat easier to understand than the systems that have followed.

4.2 Albert Raymond and Associates Study

The Raymond[169] study was very broad in scope, covering all Real Property Maintenance Activities(RPMA). A partial list of the areas where recommendations were

made follows: facilities, organization, programming and procedures, estimating, scheduling, manpower, backlog of essential maintenance, budgeting, funding, cost controls, etc. Only those recommendations pertaining to facility and job priority ranking will be discussed.

(A) A Facility Index (FI) was recommended.[170] The index was to be valuable in establishing need as a criteria rather than history and would give recognition to:

(a) the relationship of a facility to the installation mission,

(b) the relative costliness of maintaining a facility, and

(c) the relative difference in age and construction of a facility.

A numerical scale from zero or one to ten was developed for each of three factors (Appendix D):

(a) Mission Factor (MF),

(b) Maintainability Cost Factor (MC), and

(c) Replacement Value Factor (RF).

It was claimed that each facility would be quantitatively compared to each other facility by ranking the resulting indices. Through expansion to include entire installations, comparisons of installations would be possible. Combining the three factors would provide the Facility Index for each facility ranging in value

from 0 to 1,000:

$$MF \times MC \times RF = FI$$

(B) Expansion of FI by common Facility Measured Units (MU), such as square feet, square yards, etc., would result in a weighted value representing the contribution of each "category" of facilities to a composite Installation Index (NI):(171)

$$\frac{(FI_1 \times MU_1) + (FI_2 \times MU_2) + \ldots (FI_n \times MU_n)}{MU_1 + MU_2 + \ldots MU_n} = FI_b{}^1$$

In order to allow for different units of measure (square feet, square yeards, etc.) each category of facilities would be relatively weighted according to its contribution to total replacement cost, for example:

1 Facility Category	2 Weighted FI	3 CPV ($1,000)	4 % of total CPV	5 Multiply 2x4
Buildings	FI_b = 307	15,000	66.9	205.0
Square Yard Items	FI_{sy} = 172	3,000	13.3	23.0
Utilities	FI_u = 227	4,000	17.8	40.0
Ground Fencing	FI_f = 72	194	0.9	0.6
Railroad	FI_r = 72	240	1.1	0.8
	Total CPV =	22,434	NI =	269.4

The Raymond study claims that with uniform costing, staffing and scope of RPMA within and between the services,

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[1] FI_b would indicate the weighted value for all buildings; FI_u for utilities, etc. The numbers 1, 2... N represent individual facilities.

the Installation Index (NI) would be a meaningful guide for actual allocation of funds for basic maintenance activities.(172)

(C) As a second step[1] towards the development of a job priority rating system for maintenance work, a Job Factor (J) was recommended.(173) The Job Factor would depict the importance of the individual job considering its relationship to: mission accomplishment, facility life, safety of personnel, protection of facilities, facilities maintenance cost and deviation from annual work plan.[2] Therefore, the Facility Index would establish the relative importance of a facility within an installation and the Job Factor the relative importance of a job in comparison with other jobs. An example was given of determination of Job Factor for the replacement of coal fired furnaces in mobilization buildings:

	Factor
"Mission Accomplishment-Prime Mission, Essential Work	17
Facility Life-Failure Possible-5-25 Years	9
Safety of Personnel-Failure Possible	13
Protection of Facilities-Prime Mission, Failure Possible	13
Maintenance Cost-Not Available	0
Deviation from Annual Work Plan-Not Applicable	0
Job Factor	52".(174)

[1] The first step is the determination of the Facility Index (FI).

[2] See Appendix D for examples of numerical values and additional comment for each of these items.

(D) The third step in developing a job priority rating system is to combine the Job Factor (J), and Facility Index (FI), to obtain the Priority Rating Number (PRN):(175)

$$PRN = FI \times J$$

Therefore, PRN establishes a relationship between the importance of facilities on an installation and the importance of the particualr job involved.

(E) By taking a fourth step--include the Installation Index (NI)--the resulting expanded formula can provide a Command Priority Ranking Number (CPRN):(176)

$$CPRN = NI \times FI \times J, \text{ or}$$

$$CPRN = PRN \times NI$$

Accordingly, the most important job on the most important facility on the most important installation would have the largest number.

In defense of their facility and job priority ranking systems, Albert Raymond and Associates stated:

> "This type of data collection is based on individual judgement, but limiting these judgments to specific individual variables which are adequately bench marked increases their accuracy. Summarizing these individual components into one figure is considerably more accurate than attempting to start from a composite overall judgment without a guide for its consistent <u>level</u> of application. This has been proven many times in different phases of industrial management."(177)

It was pointed out, however, that "Unless and until all installations and each military department maintains inventory records and classifies facilities on a

common, uniform basis, there can be no objective analysis and comparison at the DOD level, and a valuable index will be unavailable to management."(178)

It should be noted that this system of facility and project priority ranking does not provide ratings of facility condition; it does not answer the question, "What should be done?"[1] What it does provide is a system of determining the most important jobs, the most important facilities and the most important installations. What still is required is some method of determining facility condition; some way to answer the question, "How much of our limited resources should be applied to the maintenance and repair of real property facilities?"

4.3 Facility Condition Evaluation (FCE) Studies

Several attempts have been made to develop facility condition evaluation systems. In a study, Facility Condition Evaluation, the Real Property Maintenance

[1] Condition of facilities is "implied" in the selection of numerical values for five of the six items that determine Job Factor (see Appendix D). Four of the items (Mission Accomplishment, Facility Life, Safety of Personnel, and Protection of Facilities) increase in numerical value from "essential work" to "actual failure" (condition evaluation). Condition is implied under Facility Maintenance Cost in that numerical values increase as annual maintenance costs increase (expressed as a percent of the present replacement cost of the facility).

Management Staff, DASD (P & I), April 1965, discussed the problem of facility condition:

> "Staff visits to field installations, reports through official channels, and special studies by consultant firms indicate the need for a uniform, systematic, standardized approach to evaluation of facility condition and maintenance requirements. No uniform method is currently in use on a DOD-wide basis, whereby an installation commander can compare the relative conditions of the various facilities for which he is responsible and determine which should receive priority in allocation of resources. Similarly, no uniform procedure is available for use by a commander of more than one installation for fair and impartial evaluation of needs. This problem is greatly magnified at each succeeding higher staff level and results in major decisions based entirely on judgement rather than fact; thereby resulting in resource allocation, as previously stated, on the basis of past experience rather than current needs... The prevailing philosophy appears to be a matter of giving the most to the one who can "yell the longest and loudest"... There are also indications that facility maintenance is programmed largely on the basis of impact on the base mission and that only such work as has a direct bearing on mission warrants accomplishments."(179)

A system to correct the above problems by providing a facility condition evaluation consisting of three parts was proposed.(180)

(A) Prior to physical inspection, the components of each facility would be evaluated and rated according to their individual importance and contribution to the structural integrity of the facility to meet its assigned purpose and use. This would result in a Component Rating (CR), for example: foundation, 10; roof, 8; doors and windows, 3; etc. During the cyclic inspections, the

actual condition of the component would be determined and rated by a factor called Component Condition (CC), for example: failed, 9; health or safety hazard, 6; essential maintenance, 4; etc. The sum of each component's CR and CC establishes the Component Condition Index (CCI) for that component.

(B) Following physical inspection and development of CCI's, the Facility Condition Index (FCI) is determined by summarizing all CCI's for a particular facility. The CCI's and FCI's could be used as a guide to identify and program priority work requirements.

(C) The Installation Condition Index (ICI) would be obtained by averaging all FCI's, for example:

Facility	FCI
Administration Bldg. #123	99
Administration Bldg. #124	115
Runway #3	80
Roads	65
etc.	etc.
Total (100 Facilities)	9,280
ICI	=92.8

On 24 November 1965, the OASD (I & L) requested that each service field test the Facility Condition Evaluation (FCE) proposal developed above. The results of these field tests follow.[1]

[1] Results of the field test by the Air Force were not located by the author.

4.31 Navy Field Test of FCE

The Navy tested the proposal outlined under 4.3 above during the period February to June 1966 and reported test results in Field Test of the Facility Condition Evaluation.[181] Some of the conclusions in this report were:

> "The number of variables involved in a decision on component condition are too numerous to expect consistent decisions on a simple condition rating... The proposed FCE provides no way to reflect the magnitude of a deficiency or maintenance problem related to any component... There is no way to reflect multiple deficiencies or problems within a component... The proposed FCE does not weight the structure score or facility index to reflect the size or value of the structure... Much disagreement was involved in attempting to rank the relative importance of components."(182)

An alternate system consisting of the following procedures was tested by the Navy:

> "(1) Perform detailed inspection annually.
> (2) Identify requirements necessary to restore or maintain the facility to its normal designated condition.
> (3) Provide estimates for requirements identified.
> (4) Summarize the dollar value of the requirements and divide by the facility value to obtain individual facility index.
> (5) Summarize total facility requirements and divide by the total facility value to obtain the overall installation condition index.
> (6) Report annually the indices obtained."(183)

In conclusion it was recommended that, "... any system used be based on relating the dollar value of maintenance requirements determined by inspection to the value of the facility or installation involved."[184]

4.32 Army Field Test of FCE

The Army contracted with the Technical Services Corporation to field test the proposed Facility Condition Evaluation (FCE) System (4.3 above). Their findings were submitted in An Evaluation, Study, and Test of a System for Facility Condition Evaluation, 28 June 1966.[185] Technical Services Corporation (TSC) saw the proposed FCE as conceptual in nature and an excellent point of departure for developing a system. In development of a system, TSC considered four possible mathematical models.

(A) The Averaged-sum Model proposed by DOD (4.3 above) was rejected by TSC because:[186]

(a) The Component Rating (CR) was found to be only an apparent weighting factor. The Facility Condition Index (FCI) was found dependent only on the total sum of the Component Conditions (CC's) within a facility.

(b) No weighting factor was found to reflect the relative importance of facilities within an installation.

(c) Bacause the FCI's were found dependent only on the total sum of CC's, and since no facility rating was employed, the Installation Condition Indices (ICI) depend only on the total sum of the CC's.

(B) The second model tested was called the

Prime Factorization Model.[187] This model was rejected because:

(a) The computed indexes were found cumbersome.

(b) One large FCI could dominate the computed ICI causing practically significant factors to become mathematically insignificant.

(C) The third model tested, the Adjusted Sum-product Model, was adopted for use at the installation level and has the following characteristics:[188]

(a) Assign an integral number from zero to ten to the components of a facility in ascending order of relative importance. Call the number the Component Rating (CR).

(b) Assign a number from zero to one hundred to each component of a facility to correspond to a maintenance condition ranging from "no work required" to "failed" respectively. Call the number the Component Condition (CC).

(c) Assign an integral number from zero to one hundred to each facility in an installation in ascending order of relative importance. Call the number the Facility Rating (FR).

(d) Compute an index called the Component Condition Index (CCI) for each component by taking the product of CC and CR.

(e) Compute an index called the

Facility Condition (FC) for each facility by dividing the sum of the CCI's of its components by the sum of the CR's of its components.

(f) Compute an index called the Facility Condition Index (FCI) for each facility by taking the product of its respective FC and FR.

(g) Compute an index called Installation Condition (IC) for each installation by dividing the sum of the FCI's of its facilities by the sum of the FR's of its facilities.

(D) The Fixed-bound Sum-product Model was the final model tested and was the model selected for use at higher command levels.(189) It was rejected for use at the installation level due to its requirement for more sophisticated computer equipment than is usually found at this level, and, the indexes resulting are small fractions considered to be of little value as management tools for local maintenance planning. The model has the following characteristics:

> "(1) Fixed bounds for all model formulae. All formulae take decimal fraction values between zero and one.
> (2) Assignment of a decimal fraction between zero and one to each element in the DOD plant to indicate that fraction of the mission of the next higher element that it contributes.
> (3) Assignment of a decimal fraction between zero and one to each lowest level element (i.e., component) in the DOD plant to indicate that fraction of its mission that is deficient for maintenance reasons.
> (4) Computation of a decimal fraction between zero and one for each element in the DOD plant

> to indicate that fraction of its mission that is deficient for maintenance reasons.
> (5) Computation of a decimal fraction between zero and one for each facility in the DOD plant to indicate its priority in the allocation of maintenance resources."(190)

Some of TSC's conclusions were:

> "... Subjective judgements and intangible concepts will play a major role regardless of degree of refinment... The cost of implementation of the system should be more than offset by increased allocation and maintenance efficiency... For efficacious implementation of the system, uniform standards of evaluation, repair costs, and other subjective determinations must be agreed upon."(191)

4.33 Current Status of FCE

The most current information found by the author regarding the status of OSD's efforts to establish a Facility Condition Evaluation System is an OSD "draft" titled Facility Condition Evaluation, dated 23 September 1966.[1](192) In this draft it was pointed out that a significant effort by the most knowledgable personnel in the three military departments had been expended in the testing of a Facility Condition Evaluation System. A revised concept for facility condition evaluation was proposed:(193)

(a) inspect facilities, identify unfunded deficiencies, and estimate the cost to correct these deficiencies;

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[1] Intuitively, since this is a "draft," it would seem that something more current does exist. More research effort is required in this area.

(b) set up a ratio of deficiency correction cost related to a total cost figure that will provide a number or percentage which will be useful for comparison to similarly derived data for other facilities at the same or other installations; and

(c) utilize data thus obtained, as an aid for funding priority determination (not as a substitute for judgement).

It was concluded that, "The establishment of any major new data collection and reporting system such as the use of current plant value or plant replacement value should be considered after all efforts to use existing data already being collected and reported have proved infeasible."[194]

4.4 Navy Special Projects Rating System

The Navy established a validation and rating system for special projects through BUDOCKS Instruction 11014.38 in March 1964.[195] This system was established to insure funding of the most essential projects consistent with availability of funds. The current instruction, NAVFAC Instruction 11014.38B, is essentially the same as the original instruction.[196]

The Navy, after study of the Raymond report (4.2 above), extracted certain points and integrated them into the present validation and project rating

system.(197) This system is devised to place a project in an order of relative importance with the projects, through consideration of five basic factors:

(a) relationship of the project to the mission of the activity;

(b) duration of requirement for the facility;

(c) economic considerations;

(d) probable future damage to facility and/or impairment to operations; and,

(e) non-maintenance factors.

These five factors are broken down into numerically weighted elements. For example, Relationship of the Project to the Mission of the Activity has the following breakdown:[1]

"1. Relationship of the Project to the Mission of the Activity

a.	Vital and Direct with Urgent Operational Need	3.0
b.	Vital and Direct	2.0
c.	Direct	1.6
d.	Indirect	1.2
e.	No Effect	1.0"(198)

The rating is determined by choosing a weighted element value under each of the five factors and then multiplying them together. The resulting product is then multiplied by 100. For example:

$$3.0 \times 3.0 \times 1.0 \times 1.6 \times 1.3 \times 100 = 1872$$

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[1] Appendix E contains the project rating factor numbers and definitions, and an example of a completed Special Project Request Form.

Each Engineering Field Division (EFD) reviews all special projects requests in their respective geographical areas to insure that optimum solutions (technical aspects) are being proposed. Validation of the projects is accomplished by a team consisting of at least one engineer from the EFD and one or more representatives of the activity concerned. Upon completion of an on-site review, the team develops a preliminary rating which is subsequently reviewed and approved or modified by the EFD. Validations are effective for a maximum period of two years and may be revalidated more frequently if desired.

The Special Project Rating System has been succesfully used with little modification for six years. However, some difficulty with Navy-wide application has been encountered. The difficulty was discussed in a "workshop" of a recent NAVFAC conference:

> "The present rating system, NAVFAC Instruction 11014.38B, is considered to be an acceptable and useable system in determining the urgency of a project. However, the numerical rating assigned to similar projects by different EFD's show a marked difference. In 1968, two rating seminars were held to discuss these differences, one at San Diego and the other at Charleston. Eight projects were rated by representatives from each EFD and a comparison of numerical ratings indicated that considerable variations existed between the various EFD's. Improvement in the consistencies of the EFD rating is desirable so that the use of the system would be of more value to the major claimant and type commander in developing execution plans for repair projects."(199)

This difficulty was discussed with NAVFAC personnel.(200)(201) It was agreed that ratings are valid only to the extent that ratees apply uniform standards. Since the ratings are reviewed at the EFD level, they can theoretically at least be valid throughout the EFD area, and beyond if ratees have identical background and values. It is realized that this is not so but it is probably as close to an ideal system as is currently possible. Priorities for project funding are determined by the major claimant by a process that the claimant is at liberty to establish.[1] It was stated that claimants do utilize the NAVFAC assigned ratings; that project funding priorities and NAVFAC ratings compare favorably.(202)

4.5 Cost of Deferred Maintenance Study

Two of the main effects to the Navy of inadequate maintenance funds stated under 1.1 were; accelerated deterioration of facilities, and the probability of greater cost when the postponed work must be done later. In Real Property Maintenance Fact Sheets, May 1964, NAVFAC discussed the areas affecting growth of maintenance backlog cost and listed these factors:(203)

(a) price escalation,

(b) accelerated deterioration factor, and

(c) aging plant.

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[1] The author did not interview major claimant personnel and therefore does not know what procedure they employ in assigning priorities.

It was pointed out that price escalation can be documented for any time period; factors for accelerated deterioration and aging plant cannot. NAVFAC uses an estimated three percent per year for the accelerated deterioration factor and two percent per year as an estimate of cost increase due to aging plant.

In a study, Public Works Maintenance in the Navy: Evaluation of Critical Factors, Planning Research Corporation developed a methodology to determine the total annual cost of deferring maintenance.(204) Emphasis in the report was placed on items categorized as backlog of essential maintenance.

The total cost of deferred maintenance was conceived of as having two major elements: the cost incurred by the actual performance of the maintenance action, and the incremental cost incurred because the action has been deferred for any reason. The major emphasis in methodology development was placed on the evaluation of the incremental cost. Three major factors were identified as contributing to incremental cost of deferrance:

> "(1) the loss in efficiency in performing the mission resulting from an uncorrected deficiency;
> (2) the possible increase in the extent of the deficiency resulting in a change in the scope of the maintenance action when it is performed; and,
> (3) certain economic aspects, such as changing labor costs or inflationary (or deflationary) trends."(205)

Annual ownership cost was defined "... as the prorated investment (over the years of intended use) and the average annual maintenance expenditures required to attain the intended useful life. Therefore, any reduction in the intended useful life of real property constitutes a significant increment in such costs."(206)

It was said that a deferred maintenance action could represent a loss in efficiency in mission performance in two ways: some functions may be denied because of the deficiency, or it may be necessary to perform obligatory functions by alternative means to accomplish the mission.

Therefore, ownership costs and mission-related costs are estimated as the incremental annual cost resulting from deferred maintenance. For example, any deferred maintenance that will cause a shortening of the useful life, will cause the investment to be prorated over fewer years thereby increasing the annual ownership costs. In addition, deferred maintenance may cause an increase in the average annual maintenance expenditures. These increases are the ownership costs that when added to the mission-related costs, give the incremental annual cost resulting from deferred maintenance.

Detailed discussion of the above was given and examples shown of application of the methodology to three tasks: repair of bituminous roads, paint exterior

of buildings, and major repairs to concrete piling. In the road example it was determined that for a particular road, an estimate of the daily load applications together with the thickness of surface and base must be known to estimate the service life of the road or the number of years between resurfacing.[207] In the paint example the annual cost of deferring was less than 20 percent of the cost of performing the task and therefore maintenance might be deferred.[208] In the concrete piling example the cost of deferring maintenance was less than 10 percent of the repair cost.[209]

Under "Information Needed for Cost Equations," Planning Research Corporation listed the following inputs as required for cost of deferring maintenance estimation:[210]

(a) explicit description of task to be performed,

(b) cost of replacement of the defective item or cost of the major repair,

(c) cost of "alternative" minor repair,

(d) cost of replacement of the total facility,

(e) cost of utilizing alternative methods to accomplish the function(s) of the deficient facility,

(f) estimated percent usable capacity of a defective facility,

(g) number of years since last major repair,

(h) cost of last major repair,

(i) year facility was originally constructed,

(j) number of years before major repair is required,

(k) amount of maintenance money spent on defective item since constructed or last major renewal, and,

(l) estimated additional life as a result of performing the maintenance task.

From the foregoing it can be seen that the data requirements for cost of maintenance deferral determinations are extensive. NAVFAC currently assumes a cost of effect of deferral of three percent and states that the three percent figure may be invalid, but a technique for precise quantification is not apparent.[(211)]

4.6 Summary

An attempt has been made in this chapter to acquaint the reader with some of the studies that have been made by the services and consultants relating to real property condition. No attempt at evaluation of the various proposed systems was made. A discussion of a Special Project Rating System that the Navy uses has been presented.

Top managers recognize the need for a means of rating the condition of facilities; however, none of the proposed systems have been implemented.[1] The systems'

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[1] The Navy's Special Project Rating System (4.4) may be considered a partial implementation of the Raymond system (4.2).

proponents have pointed out that their systems are based on individual judgement; that all installations and military departments must maintain inventory records and classify facilities on a common, uniform basis if their systems are to be effective.

The Navy's Special Projects Rating System is considered a useable system in determining the urgency of projects. Improvement in the consistencies of the numerical ratings is required; however, the project funding priorities established by the claimants, and the NAVFAC ratings, compare favorably.

A study of a methodology for determining the cost of maintenance deferral was introduced. Extensive data is required for the implementation of this methodology.

5.0 BEMAR RELATIONSHIPS

This chapter will discuss in more detail some of the items previously presented (Operations & Maintenance (O & M) Appropriations, maintenance "floor", Real Property Maintenance Activities (RPMA)), and introduce those items that are pertinent to the BEMAR problem not previously presented (non-O & M appropriations, BEMAR exclusions, RPMA as a program element). The author has purposely delayed presenting important BEMAR relationships with the intent of preparing non-expert readers for this chapter. Some will find this material confusing and may require reference to the cited items to meet their needs. No attempt has been made to detail relationships. Rather, the purpose of this chapter is to make the reader aware of these relationships and provide order of magnitude comparisons of influence on BEMAR.

5.1 Operations and Maintenance Appropriations

The Operations and Maintenance Navy (O & MN) Appropriations provide the funds necessary for the operation and maintenance of the Navy. A partial list of the items funded under this appropriation follows:[212]

(a) operation and maintenance of aircraft and vessels,

(b) design of vessels,

(c) training and education of members of the Navy,

(d) welfare and recreation,

(e) medical and dental care,

(f) repair of facilities, etc.

In the DOD Appropriations Act, 1970, $5,037,300,000 was appropriated for O & MN, of which not less than $147,500,000 was to be spent for maintenance of real property facilities (maintenance "floor").(213) In order to provide order of magnitude comparisons the O & MN Appropriation is listed with other Navy appropriations:(214)

Military Personnel, Navy	$4,368,400,000
Reserve Personnel, Navy	131,400,000
Operation and Maintenance Navy	5,037,300,000
Procurement, Navy	6,619,900,000
Research, Development, Test, and Evaluation, Navy	2,186,400,000
Military Construction, Navy	300,000,000*
Family Housing, Navy and Marine Corps:	
Construction	52,000,000*
Operations and Maint.	95,000,000*
Debt Payment	30,000,000*

5.11 Maintenance Floor

As noted above, the "floor" for fiscal year (FY) 1970 was $147,500,000. As stated under 2.41 the "floor" was established by Congress to ensure that maintenance funds would not be diverted for other purposes. Three kinds of maintenance work are included in the "floor":

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* Approximate figures only. Figures not marked (*) are from the reference cited.

minor construction, recurring maintenance, and major repairs costing $10,000 or more (BEMAR). By "migrating" funds from other areas of the O & MN Appropriation, it is expected that funding in the "floor" area for FY 1970 will be as follows:(215)

Minor Construction	$ 10.2 million
Recurring Maintenance	121.8 million
Major Repairs (BEMAR)	19.4 million
Total ("floor" funding)	$151.4 million

Since minor construction is construction and not maintenance or repair, some have argued that: "Minor Construction, O & M funded, should be excluded from the "Maintenance Floor" and supported in budgets as part of operations, rather than maintenance."(216) This argument was discussed in a NAVFAC interview.(217) Minor construction could be removed from the "floor", however, the purpose of minor construction can be considered an effort to keep a facility in condition suited to its purpose. This is essentially the same purpose as maintenance. Also, the "floor" presents a restriction on the use of resources; limits the manager's flexibility in fund usage. By keeping as many cost accounts as possible in the "floor" and/or by keeping the "floor" as low as possible, the manager's flexibility is increased. Therefore, managers will be reluctant to voluntarily remove minor construction from the "floor". Since minor construction has its own cost account,

"visability" of minor construction expenditures is not changed by either retaining it in or removing it from the "floor".

As shown above, recurring maintenance expenditures for FY 1970 are expected to be $121.8 million of the $151.4 million "floor" (about 80%). Recurring maintenance is generally thought of as the budgeted for "... recurring day-to-day, periodic, or scheduled work required to preserve or restore a real property facility to such condition that it may be effectively utilized for its designated purpose."[1] (218) In other words, this is the maintenance work normally budgeted for by the activity and normally expected to be performed during the year on buildings, waterfront structures, surfaced areas, grounds, utility plants and distribution systems, etc.

Repair is defined as: "... the restoration of a facility to such condition that it may be effectively utilized for its designated purpose by overhaul, reprocessing, or replacement of constituent parts or materials that have deteriorated by action of the elements or usage and have not been corrected through maintenance." (219)

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[1] Since the specifics of recurring maintenance, minor construction, major repairs, construction, etc., are very detailed, no effort is made or considered required, to present this detail in this thesis. The reader is refered to the references cited in the text and the Glossary for details.

Normally, items of repair of a minor nature will be funded from the activity O & MN funds as recurring maintenance. Items of repair (repair projects) estimated to cost more than $10,000 are major repairs, and are submitted by the activity (via NAVFAC for approval) to the major claimant for funding. As reported under 4.2, it is thought by certain reviewers that this procedure of requesting additional funds necessitates accurate reporting of facility condition, keyed to operational requirements. This is said to be required to prevent activities from deferring essential maintenance and performing not-so-essential maintenance in the hope of obtaining additional funds through the submission of major projects (BEMAR). If the major repair projects are not funded, then it would be expected that deterioration of facilities would accelerate. This condition was expected in 1969 following two years of loss of "single executive for real property maintenance" by NAVFAC (see 2.0). Expenditures for recurring maintenance had increased, funding of major repair projects had decreased, and BEMAR growth had accelerated (see Figure 5). In an effort to increase major repair funding, CNO directed major claimants with BEMAR to, "... apply at least 20 percent of their assigned FY 1970 maintenance funds to the accomplishment of major repair projects."(220) In a NAVFAC interview, the results of this action were discussed.(221) The major claimants did spend about 20

NAVY REAL PROPERTY MAINTENANCE (222)

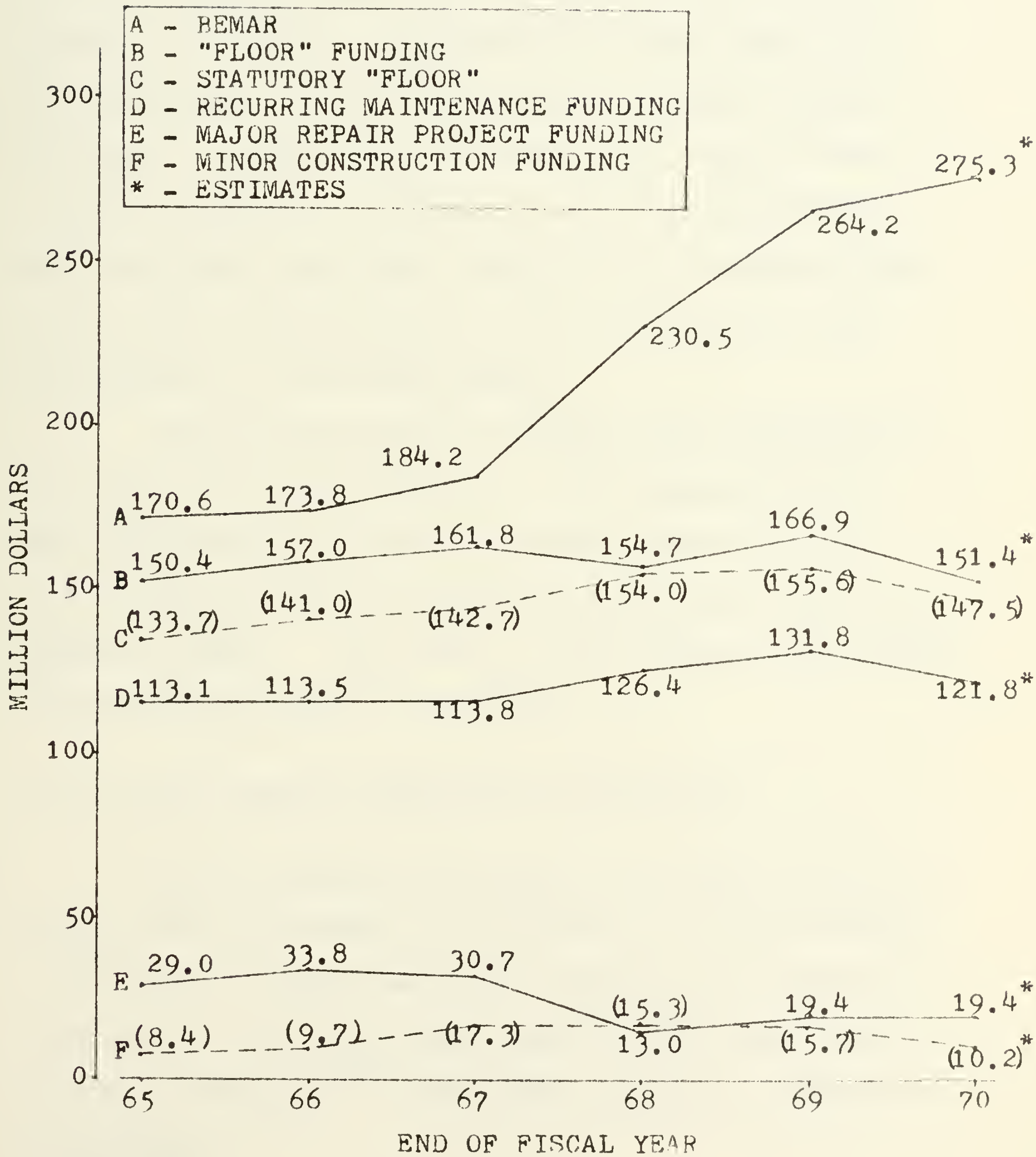

FIGURE 5

percent of their "floor" funds on major repairs, but this had little effect on BEMAR quantity. The growth trend was essentially the same in FY 1970 as in FY 1969. It was learned that the action will not be repeated in FY 1971. It had been concluded that within a fixed amount of real property maintenance funding, an increase in repair project funding can only be done by reducing funding for regular (recurring) maintenance. The net effect might well result in an increased BEMAR (more major repair projects) if essential recurring maintenance is not accomplished.

We have seen in this chapter the relationship of the O & MN Appropriation to other appropriations; the relationship of the maintenance "floor" to the O & MN Appropriation, recurring maintenance, and major repairs (BEMAR). The scope of Real Property Maintenance Activities will now be presented.

5.12 Real Property Maintenance Activities

Real Property Maintenance Activities (RPMA) refer to the maintenance and protection of real property (including installed personal property and utilities), operation of utility systems and related installation support services.(223) The RPMA include the functional categories:

(a) Maintenance of Real Property,

(b) Utility Operations,

(c) Other Engineering Support, and

(d) Minor Construction.

Maintenance of Real Property (a) includes the maintenance items listed under 5.11 above (recurring maintenance and BEMAR); Utility Operations (b), consist of purchase and/or production costs for steam, hot water, electricity, potable water, sewage, air conditioning, etc.; Other Engineering Support (c), includes public works administration and engineering, custodial services, insect and rodent control, refuse and garbage disposal, fire protection, etc.; and minor construction (d), consists of construction items funded from O & MN Appropriations.[224] The maintenance "floor" items listed under 5.11 above consist of functional categories Maintenance of Real Property and Minor Construction only. The relationship of RPMA to Facilities Management Functions will now be stated.

"Facilities Management Functions are the maintenance, alteration, repair, overhaul, and disposal of land and improvements (Class I and II property); the procurement and production of utilities and the operation of utilities distribution systems; the operation and maintenance of construction, weight handling, and automotive and railway transportation equipment; and the provision of public works engineering and other services."[225] Therefore, Facilities Management Functions include the functional categories of RPMA, and, in

addition, the automotive transporation portion of the Base Services functional category.

No attempt has been made to state the detailed relationships of all the items (functional categories) to BEMAR. Rather, what has been attempted is to provide an indication of the multitude of functions that influence BEMAR;[1] a familiarity with the terminology to describe maintenance and related functions. BEMAR (major repair projects) has been shown to be only a small part of the Maintenance of Real Property functional category. Maintenance "floor" consists of recurring maintenance, minor construction, and BEMAR. Real Property Maintenance Activities are made up of Utility Operations and Other Engineering Support functional categories in addition to maintenance "floor" items. Facilities Management Functions consist of the transportation part of the Base Services functional category in addition to RPMA. The following "grouping" of functional categories will assist the reader in understanding the above relationships:

- RPMA
  - Maintenance of Real Property
    - Recurring maintenance,
    - Major repair projects
  - Minor Construction
  - Other Engineering Support
  - Utility Operations
- Base Services, transportation

"Floor": Maintenance of Real Property (Recurring maintenance, Major repair projects), Minor Construction

Facility Management Functions: RPMA, Base Services, transportation

[1] Obviously, some of the items listed above have no influence on BEMAR (refuse and garbage disposal, transportation), and some have major influence (public works administration and engineering, operation of utilities).

5.2 BEMAR Exclusions

As stated under 1.1, Navy BEMAR applies only to the real property facilities supported by the O & MN Appropriations. Therefore, BEMAR target and procedures apply only to facilities with a CPV of $13.6 billion. The remainder of the Navy plant ($27.8 minus $13.6), $14.2 billion,[1] is supported by other than O & MN appropriations. A panel of the second Defense Real Property Maintenance Management Conference noted:

> "In the budget cycle there is significant visibility of maintenance money spent within the O & M appropriations concerning Congressional Floor area as well as the other maintenance areas. This visibility does not extend, however, to areas such as the Industrial Fund, R & D and other appropriations."(226)

This visibility and high level interest in the O & M supported facilities results from Congressional interest and the constraints applied by the maintenance "floor". The non-O & M supported areas are:

(a) Naval Industrial Fund (NIF) supported facilities;

(b) facilities supported by the Research, Development, Test and Evaluation, Navy (RDT & E,N) Appropriation;

(c) facilities supported from Military Family Housing Appropriations;

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[1] These values for CPV are valid for the start of FY 1970.

(d) Navy owned, contractor operated facilities; and

(e) Marine Corps air stations.[1]

No effort was made by the author to determine the precise methods used for the management of maintenance and backlog for the above non-O & MN appropriation supported areas. However, questions were asked of NAVFAC personnel in order to determine the major differences in procedure.(227)(228)(229) The NIF and RDT&E backlog is funded from the overhead assesment included in the charge made to customer funds by these activities. Each primary command within the Systems Commands (see Figure 3) administer their own NIF backlog in accordance with their individual charters. The major claimant is not involved. For example, NAVFAC approves the accrual of funds in overhead accounts for major repair projects at NAVFAC, NIF operated, public works center. The RDT&E Appropriation supported backlog is administered by the Chief of Naval Material (a major claimant). The family housing backlog is funded from the Family Housing Appropriation item in the Military Construction Appropriation. Navy owned, contractor operated facilities backlog is administered through contract procedures by

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[1] Revision of the funding pattern starting with FY 1971 will place Marine Corps air stations under the O & M,MC Appropriation (Operations and Maintenance, Marine Corps Appropriation).

the Systems Commands. It was learned that there is a comparable backlog in the non-O & MN supported Navy plant. In relation to CPV (backlog/CPV) it is somewhat less than $\frac{\text{BEMAR}}{\text{CPV}}$ for O & MN supported facilities. In order to provide an indication of the relative magnitudes of property involved between O & MN supported and other facilities, the following data is provided:[1](230)

Facilities Supported By	CPV as of 30 June 1967 (in billions)
O & MN Appropriation	$12.810
Naval Industrial Fund	7.460
RDT & E,N	0.879
Contractor Operated Facilities	0.681
Family Housing, Navy	1.608

It can be seen from the foregoing discussion that there are several methods in use for managing backlog of Navy facilities. Except for this brief discussion, this thesis has discussed BEMAR only (the O & MN Appropriation supported plant).

5.3 Military Construction Appropriations

Thus far only maintenance and repair of real property facilities have been emphasized in the discussion. Construction, other than minor construction funded from O & MN Appropriations, has not been mentioned. Obviously, construction of real property facilities can

[1] This data is not current (30 June 1967) but is considered by the author to be accurate enough for comparison purposes.

have considerable affect on maintenance and repair requirements and therefore on BEMAR.

The Naval Shore Facilities Planning and Programming System was implemented in 1960. This System details the planning and programming which results in the funding of construction projects through the Military Construction Appropriations. Within this System, NAVFAC is responsible for providing technical support to commands. These responsibilities include:

> "Perform military installation planning and civil engineering, shore activity item planning, master planning of installations, and analysis of systems, types and categories of installations and facilities... Formulate and prepare annual and other military construction programs..."(231)

Much effort is expended at NAVFAC and EFD's to insure that maintenance requirements are considered in all construction projects.

There is concern that nearly all new facilities are more expensive to maintain than those being replaced. Much of the reason for this can be explained through an evaluation of the systems utilized in today's facilities in comparison with those of several years ago. Today's facilities are nearly all more complex and require more maintenance effort. Most new facilities contain air conditioning systems, elevator services, complex communication systems, etc. Another factor is the pride taken by operators to maintain new

facilities in like new condition. However, in contrast to these reasons for greater maintenance costs with new facilities, there is concern that, "We may be often buying maintenance problems by designing down to a price rather than up to quality from a maintenance standpoint."(233) There has been a general consensus over the years that, "... significant increases in capital investment (both new construction and replacement), durable and long-lasting materials, and high maintainability, all incorporated in initial construction, are the most significant factors in the attainment of eventual hard savings in real property maintenance."(234) Because of the above, top management attention is being given to reducing the life cycle cost[1] of a facility, and maintenance cost is one of the major elements of this costing.(235)

As an example of this attention, NAVFAC has initiated a study to determine the effect, on initial cost and life-cycle cost of Bachelor Enlisted Men's Housing (BEMH), of using lightweight residential type construction versus heavyweight or conventional type construction.(236) Initial results of the analysis indicate that lightweight construction, based on life

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[1] The life cycle cost of a facility includes consideration of all quantifiable costs over the life of the facility for comparison with another facility of different construction.

cycle cost, may be less than conventional construction.[1(237)] Other efforts to reduce maintenance costs include the use of standard design and standardizing engineering practices for future design.

5.4 Real Property Maintenance Activities as a Program Element

In a presentation before the Real Property Maintenance Council Meeting of 30 September 1970, Brigadier General Meredith discussed "Real Property Maintenance Objectives."[(238)] General Meredith stated that, "The Air Force has requested the establishment of a program element in each major OSD program to provide the visibility and control of RPMA resources planned for the five year Defense program..."[(239)] He stated that the program element approach would insure continued program flexibility for commanders at all levels. A panel of the second Defense Real Property Maintenance Management Conference recommended that, "Separate program elements should be established for RPMA for each of the major programs in the DOD program structure."[(240)]

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[1] Therefore, the statements indicating that increases in capital investment (long-lasting materials, etc.) will lead to savings may not always be correct. Study of life cycle costs may be required in most areas to determine what types of construction will provide the economically best facility.

[2] See 5.12 above for definition of Real Property Maintenance Activities (RPMA).

In Planning-Programming-Budgeting (PPB) System, the Bureau of the Budget defined program elements:

> "A program element covers agency activities related directly to the production of a discrete agency output, or group of related outputs... Thus, program elements are the basic units of the program stucture.
>
> Program elements have three characteristics: (1) They should produce clearly-definable outputs, which are quantified wherever possible; (2) Wherever feasible, the output of a program element should be an agency end-product--not an intermediate product that supports another element; and (3) The inputs of a program element should vary with changes in the level of output, but not necessarily proportionally."(241)

The Department of Defense defines program element as:

> "The basic building block of the Five-Year defense Program (FYDP) that is a description of the mission to be undertaken and a collection of the organizational entities identified to perform the mission assignment. Elements may consist of forces, manpower, material services and associated costs as applicable."(242)

From the above definitions it can be seen that there may be difficulty in "selling" the concept of RPMA as a program element. Perhaps, as in 2.0, the conflict over the ultimate purpose of facilities will be the issue. The "key" questions that must be resolved will be: (a) do RPMA produce a clearly definable output; and (b) is the output an end-product, not an intermediate product that supports another element?

The mechanics of implementation will cause difficulties if the concept is adopted. An example of these difficulties to the Navy follows:

"a. The existing Base Operations elements would be fractionated so as to no longer reflect total costs for Naval Bases and Shore Activities.

b. The establishment of separate program elements for Real Property Maintenance Activities would imply a major change in financial management policy in the Department of Defense. This would require the establishment of completely new ground rules for accounting and information systems design in the Department of the Navy. From a bookkeeping standpoint, it would be costly.

c. The program element structure today is designed to support management on a program (mission and task) basis along command lines. With the proposed alterations, the program element structure would no longer support the present management policy. Such a change would signal a revision to management along functional lines.

d. The proposed realignment of the structure is contrary to Resources Management and the principals of Project Prime; ..."(243)

It can clearly be seen from the foregoing that if RPMA are adopted as a program element, the implementation may have considerable financial management and organizational implications.[1]

5.5 Summary

Several pertinent relationships to the BEMAR problem have been presented. The Operations and Maintenance (O & M) Appropriation has been compared with other appropriations. The relationship of the

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[1] The program element concept has been introduced. No attempt will be made in this thesis to evaluate its implications.

maintenance "floor" to the O & M Appropriation was presented. Minor construction, recurring maintenance, and major repairs as they relate to the "floor" have been more fully discussed than in previous chapters. The scope of Real Property Maintenance Activities (RPMA) and Facilities Management Functions has been presented.

It has been seen that a multitude of functions influence BEMAR, and that there are several other methods for managing backlog. The point of decision for maintenance resource allocation differs among the various appropriations. It has been pointed out that BEMAR receives top management attention while non-O & M facilities backlog receives somewhat less.

Initial results of an analysis of lightweight construction vs. conventional construction, based on life cycle cost, indicate that lightweight construction may be less expensive for Bachelor Enlisted Men's Housing.

The probable difficulties of implementation of a proposal to make RPMA a program element have been presented.

6.0 SUMMARY

Backlog of Essential Maintenance and Repair (BEMAR) is used by the Department of Defense (DOD) as a facilities condition indicator for justifying requests from the shore station commands and activities to the departments (Army, Navy, etc.), DOD, and the Congress for funds in the public works area (BEMAR is used as an indicator since no other indicator is available). The allotment of Operations and Maintenance (O & M) funds is based on prior year's funding, manpower allowances, BEMAR, and service use of BEMAR funds.

The increasing trend in dollar value of BEMAR results from: the inability to initially obtain or retain sufficient funding in the maintenance "floor" area; the fact that the major portion of maintenance "floor" funds goes for recurring maintenance, leaving an insufficient balance for elimination of the BEMAR; escalating costs for labor and material; and, additional costs incurred due to deferrals and deletions of major construction projects.

The main effects to the Navy of inadequate maintenance funds were listed as: detriment to readiness and fleet support, adverse working and living conditions for personnel, accelerated deterioration of facilities, and the probability of greater costs when the postponed work must be done later. It was stated that there is

no apparent deleterious affect on Navy operations due to these effects; that decision makers have lost confidence in the credibility of BEMAR as an indicator. Some of the reasons for this credibility loss were stated: (a) the lack of apparent adverse effects indicates an overstatement of needs; (b) since commanding officers have the authority to expend their resources as they see fit, there can be no such thing as an essential maintenance deficiency; and (c) for any level of funding, the services will fund the essential items. Statements were made concerning these reasons: (a) commanding officers may disregard their long term maintenance requirments (let their successors worry about it); and (b) commanding officers may alter their operation to accommodate to the deficiencies, and thereby perform their mission, but not necessarily in an effective manner.

A conflict was noted over the purpose of facilities. Commanding officers view facilities as another resource to use in support of their missions, while others view facility maintenance management efforts as preponderantly a function of occupancy or vacancy, not of level of activity. This may be due to an apparent conflict over the definition of maitenance policy and essentiality: (a) should there be a uniformily high standard of maintenance to act as a cushion so that

facilities will withstand the period of neglect that occurs after mobilization, or should the overriding role of real property maintenance be to assure that facilities meet the commander's requirements for mission readiness; and (b) does essentiality mean that delay of accomplishment will impair military readiness and capability or cause significant deterioration; or, does essentiality mean that from an engineering judgement standpoint, considering only the designated purpose of the facility, deficiency items should be accomplished during the current fiscal year? A similar conflict was indicated in the discussion of the proposal to make Real Property Maintenance Activities a program element: (a) do Real Property Maintenance Activities (RPMA) produce a clearly-definable output; and (b) is the output of RPMA an end-product, or an intermediate product that supports another element? Efforts are now in process to standardize maintenance and repair definitions and terms in order that BEMAR credibility will be enhanced.

Congress has shown its concern over maintenance deferral by instituting the maintenance "floor". Top management has resolved to reduce the BEMAR on several occasions over the years, yet BEMAR continues to increase. The latest attempt to reduce BEMAR to target resulted in no additional funds for this purpose, but did

recognize reduction to target as an authorized level of expense if and as the Navy chooses to reprogram its existing funds to that purpose.

Before NAVFAC (Naval Facilities Engineering Command) was installed as the single executive for real property maintenance there was no centralized authority to exercise system discipline or to evaluate relative need in the real property maintenance area. During its term as single executive, NAVFAC did have centralized authority for both budgeting and fund allocation in the real property area and developed techniques to evaluate relative need. There was considerable objection to this centralized authority (Commanding officers resented the loss of flexibility to manage their activities.). Today, NAVFAC is no longer the single executive for real property maintenance. Under the Resources Management System and the Unilinear Navy, NAVFAC provides advice and technical assistance to command, and command may or may not follow this advice. Since the end of NAVFAC's single executive designation the rate of BEMAR increase has accelerated.

A common denominator is needed in order to analyze management of real property maintenance among the services. Justification from several sources (Navy and consultants) was presented for the use of Current Plant Value (CPV) as that common denominator. The

Navy uses CPV to determine resource requirements and as an aid in resource allocation decisions. It was claimed that CPV recognizes size, age, growth and other significant characteristics of the plant property being maintained. The use of CPV and BEMAR $(\frac{\text{BEMAR}}{\text{CPV}})$ provides a measure of plant condition in use today. Efforts of the Real Property Maintenance Council to standardize the determination of CPV among the services were unsuccessful.

The establishment of a target for BEMAR of ¼% of CPV was questioned. Efforts to provide an explicit rationale for this target value were unsuccessful; however, it was shown that ¼% of CPV approximates the rate of plant deterioration, i.e., ¼% of CPV equates backlog to annual generation.

Managers recognize the need for a means of rating the condition of facilities. Several systems for facility condition evaluation and facility and project priority rating have been proposed by the services and consultants. System proponents have pointed out that their systems are based on individual (subjective) judgements; that all installations and military departments must maintain inventory records and classify facilities on a common, uniform basis if their systems are to be effective. None of the proposed systems have been implemented, but the Navy's Special Projects Rating

System may be considered a partial implementation of one of the proposed systems.

A study of methodology for determining the cost of maintenance deferral was introduced; however, data requirements are extensive. NAVFAC assumes a cost effect of deferral of three percent since a technique for precise quantification is not apparent.

A multitude of functions influence BEMAR (minor construction, recurring maintenance, major construction, etc.), and there are several methods for managing backlog. The point of decision for maintenance resource allocation differs among the various appropriations, and BEMAR (backlog for O & MN Appropriation supported facilities) receives more attention than non-O & MN appropriation supported facilities.

7.0 CONCLUSIONS

(A) There is a lack of confidence in BEMAR which limits its use in resource allocation decisions; therefore, a better facility condition indicator is needed. This need is more urgent today than in recent years due to a shift in national priorities. In an article in U.S. Naval Institute Proceedings, November 1970, Vice Admiral Reich[1] discusses this shift:

> "The 1971 Defense Budget outlays will be only 7% of our GNP, the lowest since 1951. DOD expenditures, as a percentage of total federal expenditures, will be 34.6%, the lowest since 1950. To compare briefly 1969 and 1971, Defense outlays are down $6.9 billion, from $78.7 billion to $71.8 billion. In real terms, considering inflationary factors, that reduction equates to $12.8 billion... Base closures or reductions have been necessary. Ship inactivations have been numerous... Generally, we are not mothballing ships bacause we don't need them, or even because they are obsolete. We are doing so to create a reduction in the overall defense outlays... It is important for all of us to realize that these defense outlay cuts are no 'drill'... We are experiencing, now, a real shift in national priorities and we must learn to live with fewer and fewer defense dollars."(244)

It appears that facilities maintenance managers must prepare for even more difficulty in justifying requests for maintenance funds.

(B) The conflict over the purpose of facilities must be resolved before the problem of evaluation of

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[1] Vice Admiral Reich was the Deputy Comptroller of the Navy from October 1967 through May 1970. On 1 June 1970 he was appointed Deputy Assistant Secretary of Defense (I & L) for Material.

facility condition can be addressed. This conflict can only be resolved through precise definition of both maintenance policy and essentiality. If facilities maintenance is to be programmed on the basis of impact on the base mission (only that work bearing directly on the mission is to be accomplished), then policy must clearly state this. If there is to be a uniformily high standard of maintenance to act as a cushion so that facilities will withstand the period of neglect that occurs after mobilization, then this must be clearly stated. If the former policy is desired, then the current DOD essentiality definition seems appropriate: only maintenance, that if not accomplished will impair military readiness and capability or cause significant deterioration, will be done. The need for more precise definition of "impairment of military readiness and capability" and "significant deterioration" is apparent. This lack of precise definition has lead to the problem with BEMAR credibility. Decision makers using BEMAR as an indicator of condition are assuming that all BEMAR items if not accomplished will impair readiness and capability or cause significant deterioration. When no such impairment or significant deterioration is demonstrated with increasing BEMAR, the conclusion of "overstatement of needs" is inevitable. The "gap" between reporters' of essential maintenance and resource

allocators' interpretation of essentiality is obvious. When the purpose of facilities is clearly understood, action may be taken toward establishment of a condition indicator.

(C) The author believes that if our maintenance policy is to provide a uniformily high standard of maintenance, then a return to the concept of a single executive for real property maintenance is required. Uniformity can best be obtained through centralized authority for both budgeting and fund allocation. The "tools" for accomplishing uniform distribution of maintenance resources appear to be available ($\frac{\text{BEMAR}}{\text{CPV}}$ or $\frac{\text{Unfunded Deficiencies}}{\text{CPV}}$). Uniform distribution of resources was being accomplished under NAVFAC as the single executive for real property maintenance. If this uniformity is desired defense-wide, the establishment of a DOD contralized authority seems necessary. It appears obvious to the author, however, that a uniformily high standard of maintenance may be desirable but will be unattainable as long as resources are limited.

(D) If our maintenance policy is not to be a uniformily high standard of maintenance, but is to be a programming of facilities maintenance on the basis of impact on mission, then the answer to the question of "What is to be done?" is not apparent. It is the author's opinion that this will be our maintenance policy

(facilities maintenance programmed on the basis of impact on mission). This concept of maintenance policy will require constant if not continuous input from resource users (activities, commands, etc.); therefore, it appears that centralized authority under this policy is not possible; that maintenance decisions must be made at the activity level. With decisions for maintenance made at the activity level, the requirement for indicators at higher levels of command for program performance evaluation and distribution of resources decisions becomes more urgent.

(E) If DOD is to analyze management of real property maintenance among the services a common denominator is essential. Current Plant Value appears to be that common denominator and should be implemented.

(F) If our maintenance policy is based on impact on mission, and BEMAR items meet essentiality criteria, then a target for BEMAR of ¼% of CPV is appropriate (assumption: ¼% of CPV equates backlog to annual generation). However, it appears to the author that it would be better to state simply that BEMAR (meeting essentiality criteria) will be accomplished as soon as practically feasible and therefore, except for the unavoidable "lag" between recognition and accomplishment, there will be no BEMAR. There seems to be little reason to disguise the target as ¼% of CPV.

(G) If our maintenance policy is to program facilities maintenance on the basis of impact on mission, then any rating system implemented must include operational priority considerations rather than just facility condition information. Decision makers will find little use for information regarding facility condition alone. What seems required then is an indicator that rates maintenance requirements according to operational priority. In the author's opinion the research for such an indicator has been done. Several systems have been proposed and certainly one of these systems or a modification of one of these systems should be implemented. The problem appears to the author to be one of either not really wanting such a system, which appears unlikely, or expecting too much precision in any system that will be implemented. All system proponents have admitted that subjective evaluations will be required, but that through the use of their systems, judgements can at least be limited to specific, individual, bench marked variables, thereby leading to a more consistent level of application. The sucess of such an approach is seen with the Navy's use of the Special Projects Rating System. This system requires subjective evaluation; is exposed to the hazards of inconsistencies due to individual values and judgements, but it does work. Through its use the decision maker's

task is somewhat simplified. The author believes that a similar system can be useful in establishing priority of facilities and installations as well as priority of projects. As stated in 4. above, the decision for maintenance must still be made at the activity level. Any system established would be used at higher levels of command for program performance evaluation and resource allocation decisions.

(H) Ultimately, decision makers need to know what the effects of their decisions will be before these decisions are made. What is needed in the maintenance of facilities area is a method of determining the effect of not performing maintenance; the cost of maintenance deferral. Any method implemented should measure all factors. It is obvious that this will not be a simple task. Determining what all factors are, saying nothing of finding ways of quantifying these factors, will be a tremendous problem. For example, how can we state quantitatively the effects of adverse working and living conditions? Do we know what these effects are? Can we quantitatively "tie" these adverse effects into such things as re-enlistment rate? The author has no answers to such questions but believes that justification of maintenance expenditures in the future will be based on these factors.

(I) The relationships of various factors on BEMAR

must be better established. We have seen that such items as recurring maintenance, and major and minor construction influence BEMAR. Effort must be made to see these relationships more clearly. The study of life cycle costs shows promise of assisting in the selection of the types of construction to be utilized for future projects. This kind of study must be continued.

(J) Maintenance resource allocation decisional procedures should be applied uniformally. Efforts must be made to standardize the decision making procedure over all maintenance activities. In the author's opinion, non-O & MN appropriation supported facilities (NIF, RDT & E, Housing, Contractor Operated Industrial Facilities) should receive the same "high-level" scrutiny that O & MN Appropriation supported facilities receive.

8.0 RECOMMENDATIONS

The purpose of this thesis is to provide an "information base" for further research (provide a basic understanding of the whole BEMAR problem) and to review BEMAR as a real property condition indicator. It is realized that what has been accomplished does little more than raise the problems involved with BEMAR, with little offered as corrective action. However, perhaps the knowledge of "What is wrong?" has been increased and therefore, steps can be taken toward determining "What to do about it?" The recommendations offered are based on the author's observations made during determination of the problems involved with BEMAR. These recommendations require further effort by researchers in order to prove their applicability. Further effort is recommended in the areas indicated below:

1. Before any indicator system is implemented, precise definition of both maintenance policy and essentiality is required. Top managers must decide if maintenance policy is to be: (a) a uniformily high standard of maintenance to act as a cushion so that facilities will withstand the period of neglect that occurs after mobilization, or (b) facilities maintenance programmed on the basis of impact on mission.

2. If maintenance policy is to be based on

impact on mission, then:

(a) "Impairment of military readiness and capability" and "significant deterioration" must be more precisely defined.

(b) Maintenance decisions must be made at the activity level with indicators available to provide higher levels of command with information to evaluate program performance and determine distribution of resources.

(c) The target for BEMAR should be zero, i.e., BEMAR (meeting essentiality criteria) will be accomplished as soon as practically feasible. There will be an unavoidable "lag" from recognition to accomplishment of essential maintenance but there seems to be little reason to call this ¼% of CPV.

3. If maintenance policy is to provide a uniformily high standard of maintenance, a return of the concept of a single executive for real property maintenance is required.

4. Regardless of what maintenance policy is implemented, then:

(a) A better facility condition indicator is required; one that recognizes operational priority. The problem is to select the best of the systems already proposed for implementation.

(b) Current Plant Value should be implemented

service wide to provide the common denominator for DOD and the services to analyze the management of real property maintenance.

(c) Justification of maintenance expenditures will in the future be based on the cost effects of deferral (the cost of not performing the maintenance). Effort must be continued toward the development of methods of determining maintenance deferral costs.

(d) Study of life cycle costs should be continued.

(e) Effort must be applied to the clarification of the relationships of items that influence BEMAR (recurring maintenance, major and minor construction, etc.).

(f) The decision making procedure for all maintenance activities must be standardized (non-O & MN appropriation supported facilities as well as O & MN supported).

APPENDIX A

C-O-P-Y

MEMORANDUM

November 26, 1969
FAC/10C/LMW:jes

FROM: 10

TO: 06

SUBJ: Thesis Subject

Ref: (a) Code 06 Memo 06112/SSHZ;jjc of 7 Nov 1969

Encl: (1) Backlog of Essential Maintenance (SECNAV Brief)

1. Reference (a) solicited proposed subjects for a thesis in the field of Public Works Management.

2. For several years NAVFAC has utilized Backlog of Essential Maintenance as a facilities condition indicator and as a basis for justifying requests to the Navy, OSD, and the Congress for funds to be applied in the public works area. The accepted target for backlog is one fourth of one percent of the current plant value. The actual backlog at the end of Fiscal Year 1968 was $230.5 million. It is projected to be $313.1 million by the end of FY 1970. The Congressionally established Maintenance Floor for FY 1970 is $147.5 million. However of this $147.5 million only 15-20 percent is available for reduction of backlog. Since the backlog is rapidly increasing each year the amount allocated for backlog reduction will not hold the backlog level, let alone reduce the backlog. Currently, OSD is in the process of evaluating a Program Change Request (PCR) for increased funding. This request is not expected to be successful.

3. The backlog has now reached gigantic proportions with respect to the target without any apparent deleterious effect upon Navy operations. This condition suggests that the $\frac{1}{4}$ percent target may not be valid, or that Backlog of Essential Maintenance is not a valid indicator of plant condition. Additionally, backlog is a difficult thing to portray in understandable terms to engineers, let alone to layman. A long period of education is necessary before reviewing authorities can be depended upon to support requirements based upon backlog and then operational requirements are not clearly set forth. From the foregoing it is obvious that there is a serious need for an indicator of real property

condition which can be developed on an engineering basis by command and which can be so related to operational necessity that it can be defended by operators backed up by engineers, rather than by engineers backed half-heartedly by operators. The indicator or indicators must be susceptible to Navy-wide as well as claimant and activity application.

4. This subject is of critical importance to NAVFAC and must be attacked at once. If LCDR Morrison can provide the answer he will have performed a most significant service for NAVFAC and the entire Navy.

5. Code 10 is the focal point to provide additional information and source data for LCDR Morrison should he select this area for his thesis. I am enclosing a brief of the recent backlog pitch made to SECNAV as additional background information.

(Signed)
W.E. Wynne

APPENDIX B

REAL PROPERTY MAINTENANCE GOALS FOR IMPROVED MANAGEMENT*

Financial Management

Refine accounting procedures.
Increase visibility of costs.
Uniformity and timeliness of data.
Improve support of budget.

Backlog of Essential Maintenance and Repair (BEMAR)

Uniform definition for <u>all</u> real property maintenance.
Purify current backlog/establish credibility.
Establish priority listing of BEMAR by Service.
Reduce backlog to manageable level.

Consolidation of Real Property Maintenance Activities

Continue feasibility surveys in areas of economical return.
Coordination of consolidation actions.
Identify and pursue cost reduction areas.
Foster inter-service agreements.
Improve uniform guidelines.

Relationship with Industry

Liaison between DOD and Plant Engineers in Industry/Universities.
Coordinate commercial technology and research.
Promote field trips.

Inter-Service Seminars

Promote emphasis on total RPMA spectrum.
Stimulate inter-service activities.
Plan for Airlie Conference on real property maintenance.
Disseminate results, procedures and techniques.

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* Goals adopted by the Real Property Maintenance Council (see 2.5).

Cost Reduction and Management Improvement Program

Review all RPMA areas for potential savings.
Establish realistic fiscal year goals.
Emphasize timeliness of reporting savings.
Reprogram savings to offset growing costs.
Establish criteria to determine need to replace versus maintenance.

Real Property Maintenance by Contract

Refine contracting procedures.
Develop fee guidance for maintenance contracts.
Increase surveillance of maintenance contracts.
Promote competition.

Automated Management Systems

Coordinate development by Military Departments.
Standardize maintenance accounting and reporting.
Establish maintenance management indices.
Develop facility condition index.

Industrial Type Government Facilities

Improve maintenance guidance.
Increase maintenance surveillance.
Improve maintenance cost visibility.

Mobile Response Forces in Support of RPMA

Coordinate requirements and training.
Formulate policy and procedures for emergency O & M support (Construction Battalion, Seabees, Red Horse).

Engineered Work Performance Standards (EPS)

Common use standards DOD-wide.
Coordinate implementation.
Evaluate work effort.

Real Property Maintenance Council

Provide leadership in maintenance management.
Foster interchange of ideas.
Topics of tangible benefit.

Tri-Service Technical Manuals

Coordinate preparation by military service.
Accelerate publication.

Utilities Operations

Use "total" cost concept in design of systems.
Standardize operating procedures.
Study fuels use/boiler conversion potential.
Utilization of manual versus automatic controls.
Promote conservation.

Craft Training (Military and Civilian)

Establish uniform standards/grade structures.
Standardize maintenance craft training requirements.
Promote integrated training programs.
Evaluate on-the-job training practices.

Other Engineering Support

Establish uniform maintenance standards.
Standardize operating practices.
Replace or maintain.

APPENDIX C

LIST OF MAINTENANCE AND OPERATIONS TECHNICAL PUBLICATIONS AND INSTRUCTIONS[245]

As of 1 October 1969

NAVFAC OR NAVDOCKS NO.	TITLE
MO-100	Maintenance of Grounds*
MO-101	Maintenance of Miscellaneous Ground Structures*
MO-102	Maintenance of Pavements (1970)
MO-103	Mintenance of Trackage*
MO-104	Maintenance of Waterfront Facilities*(s)
MO-109	Antenna Maintenance (1970)
MO-110	Paints & Protective Coatings (Army TM5-618, Air Force AFM 85-3)*
MO-111	Building Maintenance - Structures*(s)
MO-113	Building Maintenance - Roofing*(s)
MO-114	Building Maintenance - Plumbing, Heating, and Ventilating*(s)
MO-115	Building Maintenance - Air Conditioning and Refrigeration* W/CH 1
MO-116	Building Maintenance - Electrical*(s)
MO-117	Fire Alarm and Sprinkler Maintenance* - Interim Issue
MO-118	Building Maintenance - Elevators and Escalators (Deferred)
MO-119	Building Maintenance - Galley Equipment*
MO-120	Building Maintenance - Furniture and Furnishings*
MO-121	Maintenance of Shop Equipment for PWD's & PWC's (1970)

MO-125 Military Custodial Services (Army TM5-609, Air Force AFM 85-10) (1970)

The MO-100 Series replaces, for the most part, NAVDOCKS TP-PW-30

MO-200 Electric Power Distribution System - Maintenance* (Ex-TP-Pu-3)

MO-201 Operation of Electric Power Distribution System* (Ex-TP-Pu-3)

MO-202 Control of Electromagnetic Interference on Overhead Power Lines*

MO-203 Wire Communication and Signal System - Maintenance (6 Vols) (Ex-TP-Te-5)* <u>Limited to Department of Defense and Coast Guard only</u>.

MO-205 Central Heating and Steam - Electric Generating Plants (5 Vols) (Ex-TP-Pu-3)*

MO-206 Operation and Maintenance of Air Compressor Plants*

MO-207 Operation and Maintenance of Internal Combustion Engines* (Ex-TP-Pu-3)

MO-208 Central Air Conditioning and Refrigerating Plants (Ex-TP-Pu-3) (1969)

MO-209 Maintenance of Steam, Hot Water and Compressed Air* (Ex-TP-Pu-3)

MO-210 Water Supply System* (Ex-TP-Pw-12)

MO-211 Water Waste and Leakage Survey (1971)

MO-212 Sewerage and Industrial Waste System*** (Ex-TP-Pw-15)

MO-213 Refuse Disposal* (Ex-TP-Pu-1)

MO-214 Fuels (Ex-TP-Pu-3) (Deferred)

MO-215 Mobile Emergency Power Plants and Equipment (Ex-TP-Pu-3) (Deferred)

MO-218 Radioactivity in Water Supply and Waste Water Systems, Peacetime Detection and Control*

MO-300	Inactivation of Facilities* (Ex-TP-Pw-30) and Ch-1
MO-301	Reactivation of Facilities
MO-302	Maintenance and Operation of Intrusion Alarm Systems**(s) (Rev 1966) and CH-1
MO-303	Utility Targets*
MO-306	Corrosion Prevention and Control* (Ex-TP-Pw-30, Part M)
MO-307	Corrosion Control by Cathodic Protection*
MO-310	Military Entomology - Operational Handbook*
MO-311	Marine Biology - Operational Handbook*
MO-312	Wood Preservation - Operational Handbook - Interim Issue*** (This Manual was distributed on a limited basis. Revised Issue proposed by 1971).
MO-314	Herbicide Manual for Noncropland Weeds (Army TM5-683, Air Force AFM-91-22), (1970)
MO-321	Maintenance-Management of Public Works and Public Utilities*
MO-322	Inspection for Maintenance of Public Works and Public Utilities (1970)
MO-403	Navy Drivers Manual*(s)
MO-404	Snow Removal Manual (1970)
P-300	Management of Transportation Equip.* with CH 1, 2,3,4,5,6, & 7.
P-342	Fuel Storage Tank Cleaning*

*Distributed

**Upon Request from NAVFAC only

***Interim Issue Distributed

(s)Shop Editions Available

NAVFAC OR BUDOCKS INSTRUCTIONS	
11014.22C of 6 March 1967	"Technical Coordination and Support of the Maintenance of Public Works and Public Utilities"
11014.29B of 6 March 1967	"Public Works Type Maintenance Problems Arising from Field Operation Experience; promulgating information concerning"
11014.35C of 30 January 1968* With CH-1	"Public Works Type Maintenance Service Contracts at Naval Shore Facilities"
11014.45 of 9 May 1967* With CH-1	"Technical Publications Concerning Real Property Maintenance Activities"
11014.10A of 13 October 1965	"Principles Governing the Financing, Management, and Services of Building Under the Custody of the General Services Administration"
11153.4B of 9 April 1965	"Fleet Moorings, Inspection, Maintenance, and Reporting; procedures for"

Maintenance Type Specifications are listed in NAVFAC P-34

"Specifications used in Contracts for Public Works"

SOURCE: NAVFACINST 11014.44 CH-3 of 1 October 1969

APPENDIX D

MISSION FACTOR SCALE (246)

MF	MISSION CLASSIFICATION	MISSION IMPORTANCE
10	Vital to the Mission	Primary Importance
9	Vital to the Mission	Secondary Importance
8	Very important to the Mission	Primary
7	Very important to the Mission	Secondary
6	Essential to the Mission	Primary
5	Essential to the Mission	Secondary
4	Limited importance to the Mission	Primary
3	Limited importance to the Mission	Secondary
2	Unessential to the Mission	Primary
1	Unessential to the Mission	Secondary

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MAINTAINABILITY COST FACTOR SCALE

MC	FACILITY CLASSIFICATION	LEVEL OF MAINTENANCE
10 9 8	Temporary - In Use Semi-Perm. - In Use Permanent - In Use	Requires full maintenance to assure completely safe and efficient support for an indefinite period, generally over 10 years. May involve excessive repair cost or down time if not maintained. May involve high cost to maintain.
7 6 5	Temporary - In Use Semi-Perm. - In Use Permanent - In Use	Requires adequate maintenance to assure completely safe and efficient support for a limited period, generally 3-10 years. May involve excessive repair cost if not maintained. May involve moderate cost to maintain.
4 3 2	Temporary - In Use Semi.-Perm. - In Use Permanent - In Use	Requires adequate maintenance only to assure support for a period generally less than 3 years. Patch and reinforce instead of replacing. Consider breakdown and maintenance. May involve low cost to maintain.
1	Inactive - Possible Future Use	Limited maintenance to assure weather tightness, structural stability, protection from fire, erosion, pilferage, etc.
0	Inactive Surplus, Unuseable. To be Eliminated.	No maintenance to be performed. Cannibalize, Strip, Dispose of.

REPLACEMENT VALUE FACTOR SCALE (248)

RF	CONSTRUCTION PERIOD	TYPE OF CONSTRUCTION
10	Prior to 1940	Includes all types of construction
9	1940-1950	Permanent
8	1940-1950	Semi-Permanent and Temporary
7	1951-1955	Permanent
6	1951-1955	Semi-Permanent
5	1951-1955	Temporary
4	1956-1960	Permanent
3	1956-1960	Semi-Permanent
2	1956-1960	Temporary
1	After 1960	Includes all types of construction

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MISSION ACCOMPLISHMENT FACTOR

Mission Importance Items	Impact On Mission of the Facility					
	Actual Failure	Failure Imminent	Failure Predicted	Failure Possible	Mission Handi-capped	Essential Work
Prime Mission	27	25	23	21	19	17
Secondary Mission	24	21	18	15	12	9
Low Mission	16	14	12	10	8	6

This is the first of six factors contributing to total job content. To use this chart, select the proper expected life of the facility by reading down and the proper impact item by reading across. See notes below regarding proper application of data.

NOTE:

1. Do not select any value from this chart for painting.
2. Do not use this chart for safety work unless there is a definite fire hazard or a structural hazard.
3. Do not use this chart if it is possible to patch or correct the condition by minor repairs. However, use if patching has been done in the past to the point where it will no longer suffice.
4. A storm drainage ditch may be considered a facility for use of this chart.
5. Do not use this chart for minor expendable items such as refuse cans.

FACILITY LIFE FACTOR (250)

Facilities Expected Life Items	Impact on Facility Life					
	Actual Failure	Failure Imminent	Failure Predicted	Failure Possible	Mission Handi-capped	Essential Work
Over 25 Yrs.	17	16	15	14	13	12
5 - 25 Yrs.	12	11	10	9	8	7
To 5 Yrs.	7	6	5	4	3	2

Select the proper expected life of the facility by reading down and the proper impact item by reading across. See notes below regarding proper application of data.

NOTE:

1. To use the over 25 years column, the facility must have been built as a permanent facility within the last five years.

2. This chart may be used for safety work such as a fire or structural hazard.

3. Do not use any item higher than "Essential Work" for painting unless paint and putty or wood has deteriorated to the point where there are open holes. In this case use the "Mission Handicapped" item.

4. Do not consider an unpaved storm drainage ditch a facility for use on this chart.

5. This chart may be used for sealcoating roads or runways, etc.

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SAFETY OF PERSONNEL FACTO

Item	Impact on Safety					
	Actual Failure	Failure Imminent	Failure Predicted	Failure Possible	ission Handi-capped	Essential Work
Safety of People	16	15	14	13	12	11

Select numerical value only on the basis of proper impact items by reading across. See notes below regarding proper application of data.

NOTE:

To use this chart, the safety of personnel must be involved on a daily basis. For example:

1. Floor weak - possibility of falling through.
2. Gas leaking - danger of fire.
3. Roof trusses deteriorated to the point of danger.

Do not use this chart where:

1. Danger of fire spreading from the next building to this one.
2. Power failure with no auxiliary lighting could cause personal injury at night.
3. Welfare activities such as recreation and PX are involved.
4. If another route can be used to avoid the danger.

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PROTECTION OF FACILITIES FACTOR

Mission Importance Items	Impact on Protection of Facilities					
	Actual Failure	Failure Imminent	Failure Predicted	Failure Possible	Mission Handi-capped	Essential Work
Prime Mission	16	15	14	13	12	11
Secondary Mission	12	11	10	9	8	7
Low Mission	7	6	5	4	3	2

Select the proper mission importance item by reading down and the proper impact on mission item by reading across. See notes below regarding proper application of data.

NOTE:

1. To use this chart it must be possible for the condition to actually endanger or apply to more than 5% of the value or structure of the facility. Or, it can seriously endanger essential equipment.

2. Chart may be used in conjunction with the safety of personnel chart if applicable.

3. On this chart, a storm drainage ditch may be considered a facility.

4. This chart may be used to replace street lighting cables.

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FACILITY MAINTENANCE COST FACTOR

Work Item	Percent Annual Maintenance Cost of Present Replacement Cost of the Facility						
	50% & Up	40-49%	30-39%	20-29%	10-19%	5-10%	Under 5%
Any Item	12	11	10	9	8	7	0

Use this chart as applicable for items that have been included on previous listings of BEM.

Select the proper percent of maintenance costs to replacement costs. Then read across to obtain the proper factor.

DEVIATION FROM ANNUAL WORK PLAN FACTOR (254)

Work Item	Years of Negative Deviation					
	6 & over	5	4	3	2	1
Any Item	12	10	8	6	4	2

In using this chart, select the proper number of years of negative deviation. Negative deviation means the number of years of deferment of the job involved from plan. Then read across to determine the proper factor. See note below regarding proper application of data.

NOTE:

Use this chart as applicable for items that have been on prior lists of "Backlog of Essential Maintenance". For items appearing for the first time, use the one year value.

APPENDIX E

PROJECT RATING FACTOR NUMBERS(255)

1. Relationship of the Project to the Mission of the Activity

a.	Vital and Direct with Urgent Operational Need	3.0
b.	Vital and Direct	2.0
c.	Direct	1.6
d.	Indirect	1.2
e.	No Effect	1.0

2. Duration of Requirement for the Facility

a.	In Use - Required More Than 15 Years	3.0
b.	In Use - Required 7 to 15 Years	2.0
c.	In Use - Required 3 to 7 Years	1.4
d.	In Use - Required Less Than 3 Years	1.0
e.	Not In Use - Reserve Requirement	0.5

3. Economic Considerations: Savings by Accomplishment Now as Compared to a One-Year Deferment.

a.	90% or More Savings of Project Cost	3.0
b.	70-80% Savings of Project Cost	2.6
c.	50-69% Savings of Project Cost	2.2
d.	30-49% Savings of Project Cost	1.8
e.	10-29% Savings of Project Cost	1.4
f.	Less than 10% Savings of Project Cost	1.0

4. Probable Future Major Damage to Facility and/or Impairment to Operations

a.	Within 1 Year	1.6
b.	Between 1 and 2 Years	1.4
c.	Between 2 and 4 Years	1.3
d.	Greater Than 4 Years	1.0

5. Non-Maintenance

a.	Utmost Importance	1.6
b.	Major Importance	1.3
c.	Secondary Importance	1.1

DEFINITION OF RATING FACTOR NUMBER FOR SPECIAL PROJECTS (265)

1. RELATIONSHIP OF THE PROJECT TO THE MISSION OF THE ACTIVITY:

This factor is used to reflect the effect the project has on the mission of the activity. It is not a measure of the effect of the facility on the mission of the activity. It is sometimes difficult to distinguish between the two. Consider, for example, on an air station, a project to repair an inoperable door for a hangar and a project to paint the interior or exterior of a hangar. Obviously, the hangar door is much more important to the mission of the activity than the painting of the hangar. The first project has a vital and direct relation to the mission of the activity. The latter project has no effect on the mission of the activity. Yet the hangar is vital and direct to the mission of an air station.

There are a number of "gray" areas when considering the relationship of the project to the mission of the activity versus the relationship of the facility to the mission of the activity. An excellent rule to follow is to consider the relationship of the project to the mission the same as the relationship of the facility to the mission of the activity whenever the project affects the environmental effectiveness or integrity of the facility. That is, whenever the facility's environmental effectiveness or integrity is threatened, a leaking roof, an inoperable door, etc., the project relationship and the facility relationship to the mission of the activity will be the same.

a. Vital and Direct with Urgent Operational Need: This rating is applied to those projects which have a vital and direct influence on the mission of the activity and which, if not accomplished, would result in an unacceptable delay, or would restrict the activity in the accomplishment of the mission. The deferment of a runway repair project might cause a delay in completion of flight training, particularly when combined with an increase in number of students. A sudden large increase in the number of enlisted personnel at a training center, while not a change in mission, certainly affects the ability of activity to perform the mission by requiring reactivation of facilities such as training buildings, barracks, galleys and mess halls.

b. Vital and Direct Relation to Mission: This rating is applied to those projects which have a direct and applicable effect on operations of the activity. For airfields this would include necessary runway systems, refueling systems, operational hangars, etc. For shipyards it would include essential production shops and facilities, waterfront structures, drydocks, etc. For training stations this would include essential training facilities only. For other types of activities it would include similar essential facilities. Similarly, at all activities, those portions of utilities systems which serve the above facilities carry the same high rating. It is emphasized that this rating is to be applied to only those projects which have an appreciable bearing on operations which constitute mission performance.

c. Direct Support to Mission: This rating factor is to be applied to those projects which provide essential support to mission performance such as administration buildings, public works shops, security facilities where security of the facility is a primary factor, warehouses, roads and utilities serving these facilities, etc.

d. Indirect Support of Mission: This rating is to be applied to those projects which provide less than direct support to mission accomplishment such as welfare facilities, recreation facilities, civilian personnel facilities, chapels, security facilities, secondary roads and utilities, etc.

e. No Effect on Mission: All projects not ratable under a, b, c, and d shall be included under this rating. Examples include power factor correction, most maintenance painting projects, etc.

2. DURATION OF REQUIREMENT FOR THE FACILITY: This factor has been included to avoid spending limited available maintenance funds for projects of those facilities with a limited future requirement. This refers not only to the anticipated physical life of the structure, but also to the requirement for the facility which may extend only a limited time into the future. Use the lesser number of years to determine the factor rating.

a. Currently in Use - Rquired 15 Years or Longer: This rating is to be applied to projects for facilities required by the Basic Facilities Requirements List (BFRL) and for which the requirement will exist for the forseeable future.

b. Currently in Use - Required for 7 to 15 Years: This rating applies to projects for facilities with an expected requirement of 7 to 15 years. This includes facilities which serve systems or programs of limited duration.

c. Currently in Use - Required for 3 to 7 Years: This rating applies to projects for facilities with an expected requirement of 3 to 7 years.

d. Currently in Use - Required Less Than 3 Years: This rating applies to projects with an expected requirement of less than 3 years for any reason.

e. Not in Use: Facilities for which there is no existing requirement, but which are being retained to meet specific future assignments for mobilization, a planned change in mission or a planned increase in loading.

3. ECONOMIC CONSIDERATION: This factor is for the purpose of giving a higher order of importance to those projects which, upon accomplishment, will result in a saving of dollars during the first year after accomplishment. Therefore the greater the expected saving, the higher the order of importance. These anticipated savings, usually in the form of avoidance of future expenditures, can be realized from several types of costs. The most common will be the annual saving in anticipated maintenance costs that will be the direct result of the project accomplishment. Similarly, an anticipated reduction in annual operations costs, regardless of which appropriated funds benefit, should be used under this factor. Also, the expected increase in cost due to deferring the project one year, should be included as a saving whether the increase is due to cost escalation, or to expected damage to materials and/or equipment during the one year delay. It is to be noted that these costs are additive where more than one element is involved.

All of these savings must be justified in detail utilizing extrapolation of actual historical costs where available or reliable estimates based on realistic unit prices.

4. PROBABLE FUTURE MAJOR DAMAGE TO FACILITY AND/OR IMPAIRMENT TO OPERATIONS:

This rating is included to raise the importance of those projects which, if accomplished now, will avoid future costs for major damage to a facility or major interruption of essential operations. Such anticipated costs or

interference to operations must be of sufficient import to justify the accomplishment of the project. As an example, if the ring connectors on a wooden truss are not tightened as required, extensive damage could result. Or, continued deferral of pavement joint sealing could result in extensive damage to the subgrade, thereby greatly increasing the cost of repairs. Likewise, continued neglect of roof repairs may, in time, result in extensive damage to a building and/or its contents. Many projects if deferred too long, may have an adverse effect on operations. A factor greater than 1.0 should only be applied when the probability is reasonably definite. This will require a very practical and realistic approach on the part of the rating officer. The facts considered in determining the rating <u>must</u> be cited in Block 25 of NavDocks 2950, the Special Projects Request.

5. <u>NON-MAINTENANCE</u>: There are some projects which derive their importance from considerations other than maintenance, economy, and performance of mission. These projects include those whose reason for accomplishment are morale, welfare, public relations, safety, security, fire protection, air and water pollution, etc.

a. <u>Utmost Importance</u>:

1. Air and water pollution correction projects in localities where such pollution has already resulted in a serious condition.

2. Those projects which are definitely embarrassing to the Navy in its contact with the public; i.e., appearance of the station which has been the subject of sincere and serious complaints from officials of the adjacent communities.

3. Those projects which correct definite serious safety hazards to life and limb; i.e., repairs to weak or failed walkways or railings, a fall from which would probably result in serious injury; repairs required to correct deficiencies resulting in definite unreliability of a fire alarm or sprinkler system; repairs to impending failures over active personnel areas; etc.

b. <u>Major Importance</u>:

1. Those which can be positively shown to have an appreciable adverse effect on re-enlistment and/or re-employement; i.e., a barracks or an office in

deplorable condition, major heating problems wherein minimum standards cannot be maintained, very poor galley conditions, etc. To apply this rating, a large number of personnel must be affected.

2. Those which definitely are related to security, i.e., an ineffective alarm system covering an important area, repair of access roads urgently needed by emergency equipment, etc. The risk must be positive and sufficiently severe to warrant the cost of correction.

3. Air and water pollution correction in localities where such pollution has not attained a serious condition to date but is believed a definite probability within two years.

c. Secondary Importance: This rating should be applied to those projects which do not meet the full intent of the above or which affect a smaller number of personnel, but which are definitely problems in these areas; i.e., partially deteriorated fencing near a public road, improvement to interior lighting which is below standard, etc.

SPECIAL PROJECTS REQUEST
(SIDE 1)

DEPARTMENT OF THE NAVY
SPECIAL PROJECTS REQUEST
NAVFAC 9-11014/64
Supersedes NAVDOCKS 2950

SHEET 1 OF 2

1 ACTIVITY SNDL NO: 1452 142 | ACTIVITY NAME AND LOCATION: Naval Station ANYWHERE | DATE SUBMITTED: 7 Jun 196[illegible]

2 PROJECT NO: R-1-65 | TITLE: Repair Refrigeration Plant Bldg. 2

3 TYPE

a [X] MAINT./REPAIR b [ ] MINOR CONSTRUCTION/ALTERATION c [ ] AIR CONDITIONING d [ ] EQUIPMENT INSTALLATION

4 DESCRIPTION AND FUNCTION OF FACILITY

Bldg. 2 contains half the station's frozen storage space which is essential to operation of messing facilities

a. PROPERTY RECORD CARD NO: 2-00015

b. NAVY CATEGORY CODE: 14210

c. BLDG. OR STRUCTURE NO: Bldg. 2

5 WHAT IS THE EFFECT OF THIS PROJECT ON THE MISSION OF THE ACTIVITY?

Facility is necessary to maintain reliable stocking levels for operation of station messing facilities. 2 mo. stock considered minimum level. presently able to maintain 4 mo.

6 THE REQUIREMENT FOR THE FACILITY IS BASED ON:

a [ ] A CHANGE IN MISSION b [X] FULL-TIME CONTINUING NEED c [ ] 3 TO 5 YEAR NEED d [ ] LESS THAN 3 YEARS' NEED e [ ] CURRENTLY REQUIRED LESS THAN 50% OF TIME f [ ] RESERVED FOR FUTURE REQUIREMENTS

7a. EST. FUNDED COST	b. EST. PROJECT COST	c. EST. PLANNING COST	d. TOTAL FUNDS REQUESTED	e. EST. FACIL. REPL. COST
$ 85,000	$ 87,000	$ 5,1000	$ 90,100	$ 198,000

8 DATE FACILITY CONSTRUCTED: 194[illegible]

9 IS FACILITY ON AN APPROVED BASIC FACILITY REQUIREMENTS LIST? If "NO," how was need determined?

[X] YES [ ] NO

10 IS PROJECT LISTED ON ANNUAL INSPECTION SUMMARY? If answer is "NO," and AIS is applicable, explain exclusion

[X] YES [ ] NO [ ] N.A.

11 BRIEF DESCRIPTION OF CONDITION TO BE CORRECTED, OR PROBLEM TO BE SOLVED WITH PROPOSED SOLUTION. Attach additional description if necessary. ONE PAGE ONLY

Insulation and equipment have deteriorated so that it is impossible to maintain required temperatures. Project will replace refrigeration system serving frozen food rooms. Floor insulation and two refrigerator doors.

12 WHY IS THE PROPOSED SOLUTION BEST AND WHAT ALTERNATIVES WERE CONSIDERED?

Only alternative is new construction; repair is more economical.

13 WERE ANY NON-NAVY EXPERTS INVITED TO REVIEW THIS PROBLEM AND THIS SOLUTION? Explain effect on solution.

a. [ ] YES b [X] NO

14 HAS FED DESIGN DIVISION REVIEWED SOLUTION? a [X] YES b [ ] NO

15 CAN ANOTHER FACILITY BE ECONOMICALLY ADAPTED FOR THIS FUNCTION? a [ ] YES b [X] NO

*16 CAN PROJECTS BE FUNDED IN INCREMENTS? How?

a [ ] YES b [X] NO

*17 THIS PROJECT IS THE RESULT OF

a [ ] INADEQUATE HOUSING b [X] FACILITY AGE c [ ] DEFICIENT CONSTR. d. [ ] DEFICIENT DESIGN e [ ] OTHER

*18 HAS THIS SPECIFIC PROBLEM BEEN COMPLETED PREVIOUSLY?

a. [ ] YES b. [X] NO When?

HOW LONG WILL PROPOSED CORRECTIVE ACTION LAST? ______ to ______ YEARS

19 ARE COMPONENTS BEING INCREASED IN SIZE OR CAPACITY? Explain the difference, including cost.

a [ ] YES b [X] NO

SPECIAL PROJECTS REQUEST (SIDE 2)

20. ARE MATERIALS PROPOSED FOR USE THE SAME AS THOSE EXISTING? If "NO," explain the difference, including cost.

a. [X] YES b. [ ] NO

21. PROJECT IS PLANNED TO BE ACCOMPLISHED BY

a. [ ] STATION LABOR b. [X] CONTRACT

22. HAS A PROJECT EVER BEEN SUBMITTED FOR THE REPLACEMENT OF THIS OR SIMILAR FACILITIES? Check and explain if "YES."

a. [ ] YES b. [X] NO When?

23. ANTICIPATED SAVINGS IF PROJECT IS DONE THIS YEAR AS COMPARED TO A DEFERRAL OF ONE YEAR

PROBABLE INCREASE IN PROJECT COST FOR ANY JUSTIFIABLE REASON	REDUCTION IN CURRENT MAINT. COST	REDUCTION IN CURRENT OPERATIONS COST
$ None	$ 2,500	$ 1,000

JUSTIFY ANY SAVINGS INDICATED

Job orders reveal maint. costs for repairing worn out equipment averages $2,500 annually. Overtime costs for manual operation average $1,000 annually.

WHAT IS PAY BACK PERIOD OF PROJECT? (In years) 15

WILL ACCOMPLISHMENT GENERATE REQUIREMENTS FOR ADDITIONAL M&O FUNDS OR PERSONNEL? a. [X] NO b. [ ] YES 1st Ann

24. WHAT WOULD BE THE EFFECT OF DEFERRING THE PROJECT ONE YEAR?

Sufficient food could not be stored to operate messes in summer months

*25. IF THE PROJECT IS NOT ACCOMPLISHED NOW, IN HOW MANY YEARS WILL THERE BE SERIOUS DAMAGE TO THE FACILITY AND/OR ITS CONTENTS OR IMPAIRMENT TO ESSENTIAL OPERATIONS? Explain, include loss value to facility and/or contents

YEARS BEFORE SERIOUS DAMAGE OCCURS 1. Equipment will be completely unreliable in one year

*26. HAS THE REDUCED UTILIZATION OF THIS SPECIFIC FACILITY AFFECTED A LARGE FACILITY SYSTEM OPERATION? Explain

a. [X] YES b. [ ] NO BY HOW MUCH? 25 %. Cold storage capacity station wide has been reduced 25%.

27. ARE THERE ANY OTHER FACTORS INVOLVED? Check and explain.

a. [ ] MORALE b. [X] HEALTH c. [ ] PUBLIC RELATIONS d. [ ] SAFETY e. [ ] FIRE PROTECTION f. [ ] SECURITY g. [ ] OTHER

Provisions have spoiled which could result in serious health hazard

28. CERTIFICATION BY RESPONSIBLE OFFICER AT ACTIVITY. I am personally cognizant of the need for, the essentiality of, and the proposed method of accomplishment of this project and certify that the above information is correct, and that this project meets all criteria specified in OPNAVINST P 11010.20

DATE	TYPED NAME OF OFFICER AND POSITION	SIGNATURE
7 Jun 1965	LCDR G. S. High (CEC) USN CODE 80	

EFD EVALUATION BY DIRECTOR, DEPUTY, OR MAINTENANCE DIVISION SUPERVISOR. I hereby certify that this project has been thoroughly evaluated, that it is an essential project and that it is both economically and technically sound. A rating factor is hereby assigned.

29. VALID FOR RATING FACTOR

a. [X] VASP
b. [ ] PROJECTED MAINT
c. [ ] NOT VALID
d. [ ] OTHER

30. EFD Rating

** The product of (4) x (5) must NOT be greater than 2.5.
*** If safety is evaluated in (4), do not duplicate safety in the rating.

(1)		(2)		(3)		(4**)		(5**)		~~(6***)~~		
1.0	x	1.0	x	1.0	x	1.6	x	1.4	x	~~1.1~~	x 100	258

31. DATE	TYPED EVALUATOR'S NAME AND POSITION	SIGNATURE
9 Jun 1965	CDR J. Jim (CEC) USN Code 60	

ENCLS

a. [X] ENGINEERING EST (NAVDOCKS 2467) b. [X] LOCATION PLAN(S) c. [X] DRAWINGS d. [X] PHOTOGRAPHS

NAVFAC 9-11014/64 (REV. 5-65) SHEET 2 of 2

*NOT applicable to Minor Construction, Alterations, or Equipment Installation

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